PROSPECTIVE PURCHASER AGREEMENT
CLEANUP ACTION PLAN

NORTAR/Former ATCO Facility at 1700 North Northlake Way
Seattle, Washington

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1.0 INTRODUCTION

This document provides a Cleanup Action Plan (CAP) for the remediation of soils and ground water at the NORTAR/former American Tar Company (ATCO) Facility (SIS# N17-0049-000) located at 1700 North Northlake Way, Seattle, Washington (herein after referred to as the Site). Equipoise Corporation (Equipoise) has prepared this CAP on behalf of Triad Northlake LLC (Triad). Triad, is a non-Potentially Liable Party (PLP), that has expressed an interest in redeveloping the Site property, if the required remediation is not prohibitive.

This document is the result of Site characterization data obtained over the past 10 years and several meetings with the Washington State Department of Ecology (Ecology) and the State Attorney General's Office. It is the intent of this document to provide technical and regulatory compliance background that will result in an effective and efficient Site cleanup approach that can be incorporated into a Prospective Purchaser Agreement Consent Decree. The remediation activities described in this CAP include the:

- Excavation and off-Site disposal and recycling where practical of soil containing carcinogenic polynuclear aromatic hydrocarbons (PAHs) in excess of 1 milligram per kilogram (mg/kg)

- Excavation and on-Site containment of soil containing pentachlorophenol (PCP) in excess of 8.33 mg/kg following Ecology's Area of Contamination and Contained In policies;

- Excavation and off-Site disposal and recycling where practical of PCP contaminated soils less than 8.33 mg/kg;

- Excavation and removal of perched water formation contaminated with petroleum hydrocarbons and PAHs and off-Site disposal with contaminated soils; and

- Compliance monitoring for PAH, PCP and TPH and volatile organics for soils and shallow aquifer ground water at points of compliance.

Soils and perched water will be disposed at a certified subclass D or subclass C landfill and recycled where practical based on confirmation sampling at the time of disposal and with written approval from the selected landfill or recycling facility.

Compliance monitoring will be implemented to confirm site cleanup is complete and the cleanup action levels have been achieved following the MTCA statistical guidance. Periodic review will be conducted at a minimum of five years to assure that human health and the environment continue to be protected as required in WAC 173-340-420(1). The scope of work with schedule is listed in the Consent Decree's Attachment E.

1.1 PURPOSE

This CAP has been developed in accordance with the Washington State Department of Ecology (Ecology) *Model Toxics Control Act Cleanup Regulation* (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC). In accordance with Chapter 173-340-360(2) the selected cleanup action shall meet the threshold requirements and achieve MTCA method B cleanup action levels at the defined points of compliance; protect human health and the environment; comply with applicable State and Federal laws; and provide for compliance monitoring and periodic review.

1.2 SCOPE

The scope of this document is intended to address the requirements outlined in Ecology's *Model Toxics Control Act Cleanup Regulation* (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC) for Remedial Investigations (RI), Feasibility Studies (FS), and Cleanup Action Plans (CAP). As discussed during several meetings with Ecology, this document is appropriate because of the good overall understanding of Site conditions and the conceptual property redevelopment plans that include extensive excavation associated with underground parking garage construction. Site characterization investigations have accurately defined the extent and magnitude of the various chemicals of concern in subsurface soil and a perched formation water zone. The current property redevelopment plans limit the range of feasible remedial alternatives to those that include excavation. The hazardous chemicals present in the subsurface media (soil and ground water) and their reported concentrations restrict on-Site or in-situ treatment alternatives and disposal requirements are restrictive and well defined.

This CAP identifies Site-specific cleanup levels, remediation action levels appropriate for future residential use, and the particular proposed redevelopment land use. This CAP identifies the points of compliance, describes the planned cleanup action, and compliance monitoring efforts for remediation of the property. This CAP will be implemented through Triad's application for a Prospective Purchaser Agreement (PPA) with Ecology. The planned remediation will be completed pursuant to the PPA and incorporated into a Prospective Purchaser Agreement Consent Decree. A PPA proposal, Public Participation Plan and SEPA checklist are being prepared under separate cover. Each of these documents will be submitted for public comment. Based on this information, Ecology expects to issue a determination of non-significance (DNS) for the CAP, and has prepared a draft DNS. The draft DNS is also available for public review and comment.

1.3 CLEANUP ACTION PLAN ORGANIZATION

The CAP has been organized into the following Sections:

- **Section 1.0 – Introduction**: Section 1.0 introduces the CAP and presents the purpose, scope and proposed Ecology administrative mechanism for initiation and completion of the cleanup action.

- **Section 2.0 – Background**: Section 2.0 provides background Site information including, the Site location and description, physiographic setting, operational history, current Site

status, a summary of past activities of environmental concern, and a summary of the conceptual Site redevelopment plan.

- **Section 3.0 – Site Characterization Activities**: Section 3.0 presents a summary of environmental characterization activities conducted at the Site.

- **Section 4.0 – Summary of Environmental Issues**: Section 4.0 presents a discussion of the constituents and media of potential concern, the distribution of the potential constituents of concern, contaminant chemistry and environmental fate and, an assessment of risk.

- **Section 5.0 – Regulatory Framework**: Section 5.0 summarizes the regulations applicable to Site remediation and presents cleanup levels for each constituent of potential concern in the respective media of potential concern.

- **Section 6.0 – Cleanup Alternatives**: Section 6.0 presents a summary of the remediation alternatives considered for each medium of concern and presents the selected remediation action.

- **Section 7.0 – Selected Cleanup Action**: Section 7.0 presents details of the selected cleanup action including, proposed cleanup levels, area of contamination for PCP-impacted soil, soil remediation and points of compliance.

- **Section 8.0 – Compliance Monitoring**: Section 8.0 outlines the compliance monitoring to be conducted in accordance with Chapter 173-340-410.

- **Section 9.0 – Schedule for Implementation**: Section 9.0 provides the schedule for implementation of the cleanup action.

- **Section 10.0 -- References**

2.0 BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The NORTAR/former American Tar Company (ATCO) facility is located at 1700 North Northlake Way in North Seattle (Figure 1). The Site occupies approximately 1.3 acres of property that is situated on a steep south-facing slope. North to south property boundaries decrease 30 feet in elevation from approximately 60 feet above Mean Sea Level (MSL) to an elevation of approximately 28 feet above MSL. The slope extends from north of the Site southward to Lake Union. The distance to the shoreline ranges from approximately 500 to 1000 feet south to the shoreline from the southwest to the southeast property boundary. Bordering the Site to the north are retail businesses, a parking lot and North 34th Street. Bordering the Site to the south are North Northlake Way and Gas Works Park (which is situated on the shore of Lake Union). Bordering the Site to the east is Wallingford Avenue North and a brush covered vacant lot. Bordering the Site to the west is Densmore Avenue North and a parcel of property owned by King County Department of Transportation (METRO).

The Site property and immediate area is currently zoned commercial/industrial. A topographic survey map of the property produced by Chadwick Surveying and Engineering provided the following legal description for the NORTAR/Former ATCO Facility.

> *NORTAR, INC:*
>
> *Lots 3, 4, 5, and 6, Block 75 Lake Union Addition, according to the plat thereof, recorded in Volume 1 of Plats, page 238, records of King County, Washington; AND Lots 7 and 8, Block 75 Lake Union Addition, according to the plat thereof, recorded in Volume 1 of Plats, page 238, records of King County, Washington; AND Lots 9 and 10, Block 75 Lake Union Addition, according to the plat thereof, recorded in Volume 1 of Plats, page 238, records of King County, Washington.*

Several structures are located at the Site. Site features are illustrated on Figure 2. Structures include six metal buildings, one wood building, and one concrete block building. Two of the metal buildings were not part of the original ATCO Site structures. The metal building located in the southeast corner of the property was constructed in 1978; the metal building located in the northeast property corner was constructed in 1986 (refer to Figure 2). The majority of the intervening space on the property is paved with asphalt or concrete. Facility structures were constructed by excavating into the slope to create a level terrace or pad for building foundations. The property is divided into three main historical operation areas. The areas, illustrated on Figure 2, include:

- **Tank Farm Area** – The former Tank Farm Area is located in the northern portion of the Site. All the above ground tanks formerly located at the Tank Farm Area have been removed.

- **Wood Preservative Formulation Area** – The former Wood Preservative Formulation Area is located in the west central portion of the Site along Densmore Avenue North.

- **Other Operations Area** – The Other Operations Area include administrative offices and former finished product storage areas. The Other Operations Area is located in the southern and eastern portions of the Site.

The activities conducted in each of these areas are further discussed in Section 2.3-Historical Site Operations.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

The Site lies within the Puget Sound Lowland, a north-south trending topographic and structural trough between the Cascade Mountains to the east and the Olympic Mountains to the west. The trough formed a natural passageway for a succession of glacial advances from British Columbia during the Pleistocene Period. As a consequence, of repeated glaciation, the lowland (trough) has been filled with, up to 3,000 feet, of glacial drift and associated lacustrine, marine and alluvial deposits. The last glaciation referred to as the Vashon Stade of the Fraser Glaciation reportedly occurred approximately 15,000 years ago. During this glacial period, a lobe of ice blocked streams flowing out of the Puget Sound Lowland, causing a large regional lake to form. Sediment entering the lake was deposited forming a widespread deposit of clay and silt. This deposit, known as the Lawton Clay Member of the Vashon Drift (Mullineaux, 1965), is found throughout the central portion of the Puget Sound area and is well exposed in the vicinity of Seattle.

After silt and clay filled the lake, streams from the advancing glacier deposited a thick layer of sand over the Lawton Clay. This sand unit is known as the Esperance Sand Member of the Vashon Drift. The Esperance Sand unit is composed of coarse sand with pebbles, which grades into sand and gravel deposited in the front of the glacier as the ice sheet advanced. The sand and gravel materials are informally known as Advance Outwash (Smith, 1974). The contact between the Esperance Sand and the Advance Outwash is somewhat arbitrary except where there is a distinct erosional contact between coarse gravel and bedded sand.

As glaciation continued to advance southward, nonsorted, nonstratified sediment was deposited on top of the Esperance Sand. This sediment, referred to as the Vashon Till, consists of a mixture of clay, silt, sand and gravel. As the ice sheet advanced, these deposits were compressed by the weight of up to 3,000 feet of ice (Thorsen, 1980). The ice sheet retreated after reaching its maximum southerly extent, just south of Olympia. Meltwater streams from the retreating ice front and from ice-dammed lakes cut large channels and deposited sediments into low-lying areas. The majority of large-scale surficial deposits and landforms currently observed throughout the Puget Sound Lowland are a result of fluvial, lacustrine, and direct ice contact processes formed as the glacier retreated. Human activities including excavations and fill operations after the late-1800's have modified some of the natural deposits and landforms.

AGI reports that they encountered Vashon Till to a depth of 73 feet below ground surface at boring AGI-1 located north of the METRO facility and northwest of the intersection of North 34th Avenue and Densmore Avenue North, immediately northwest of the Nortar site. The Vashon Till was also located at a similar depth at the northeast corner of Gasworks Park at MW-3D. AGI describes the till as ranging from dense to very dense, trace silty to silty, gravelly sand and sandy gravel.

Previous environmental investigations at the NORTAR/former ATCO facility describe the subsurface at the Site as consisting of fill, a weathered upper sand unit underlain by till. The fill represents a veneer across the Site up to a couple of feet thick consisting of gravel and paving subgrade material. The upper sand is described as weathered, medium dense, slightly gravelly silty sand. The underlying till is described as dense, slightly gravelly silty sand. While the written description of the sand and the till units are very similar, all previous environmental reports indicate that the somewhat finer grained and denser till acts as a barrier to the downward percolation of fluids and contaminants. The sand unit thins toward the south (or downslope). Previous assessments report that the sand is in excess of 14 feet thick on the northern portion of the property and thins to a couple of feet thick along North Northlake Way, the southern Site boundary. It has been proposed that the sand unit may represent an upper weathered zone of the till or that it may be reworked till used as fill during the construction of the facility. Weathering or reworking is a possible explanation of the lower density of the sand unit (as measured by blow counts) relative to the underlying till and also the increased permeability of the sand unit, as evidenced by what appears to be an intermittent perched formation water zone.

Two water-bearing zones have been observed at the Site; a shallow perched formation water zone and a deeper groundwater table. The perched formation water zone occurs at the base of the sand unit that overlies the till. Saturated conditions within this perched zone are discontinuous. It has been suggested that this perched zone is present due to the difference in permeability/porosity between the upper sand and underlying till units (i.e. formation water at the base of the sand unit is perched on top of the till). The presence of, and depth to, perched formation water is variable. Generally, perched formation water has been observed where the thickness of the sand unit is greater. The depth to perched formation water has been observed within two feet of the ground surface in the vicinity of the former tank farm and at a depth of approximately 5 feet below ground surface in the central portion of the Site. The base of the perched formation water zone appears to follow the topography of the till surface, which mirrors the surface topography at the Site in that it slopes from the north to the south toward lake Union. In the case where sufficient formation water is present (particularly during the wet season), and hence sufficient head, perched formation water movement is toward the south following the surface topography. Ecology recently classified the perched formation water-bearing zone as non-potable based on their determination that there is insufficient yield and the extremely low likelihood that the zone will be classified as a potential future source of drinking water at the Chevron/METRO site. Ecology's non-potable determination was documented in a August 10, 1998 letter (Ecology, 1998) written to King County Department of Transportation.

The second saturated zone, or groundwater table is present within the till. Based on data provided by Ecology, groundwater movement in this zone is to the south toward Lake Union.

2.3 HISTORICAL SITE OPERATIONS

The American Tar Company (ATCO) manufactured roofing products and formulated wood preservatives at the Site for a period of approximately 35 years. ATCO conducted manufacturing and formulation activities at the Site from approximately 1956 until the late 1980's. ATCO sold the property to NORTAR, Incorporated (NORTAR) in the early 1990's. As part of the sale ATCO dismantled and removed the tank farm and associated piping, along with the majority of equipment associated with ATCO's previous business activities. Aerial photographs (1967-1995) show above ground storage tanks located at the north end of the Site from 1967 through 1992 and removed prior to 1995. The property is presently owned by NORTAR, who leases portions of the property out to a variety of tenants.

During operation ATCO produced asphalt coatings, asphalt adhesives and cements, coal tar coatings and cements, aluminum coatings, foundation/damp proofing products, driveway products, wood preservatives, building papers and fabrics, and specialty coatings. Some of the raw materials (e.g., coal tar and creosote) for the manufacturing of several of the products listed above were easily obtained as they were produced as products/byproducts of coal gasification activities that were conducted at a plant formerly located on the present site of Gas Works Park (immediately south of the Site across North Northlake Way). Other raw materials, purchased from outside vendors, included: asphalt roof coating, xylene, adhesive, refined coal tar, roof primer, gilsonite-asphalt paint, mineral spirits, carbon elastic paint, creosote, and water proof coating.

For discussion purposes, the Site has been divided in three operational areas. These areas as defined in Section 2.1 are the former Tank farm, the Wood Preservative Formulation Area, and Other Operations Area (refer to Figure 2). Wastes and historical activities associated with each of these three former operational areas are described below.

2.3.1 Former Tank Farm Area

Approximately 16 above ground tanks were formerly located across the northern portion of the west half of the Site in the Tank Farm Area. These tanks contained a variety of raw materials for the manufacturing processes. Raw materials were delivered in tanker trucks and offloaded into the tanks. Offloading occurred from the curbside along the western property boundary (Densmore Avenue North) and/or from the parking lot to the north (the parking lot bounding the northwest side of the property). Raw materials in the tank farm were piped above ground to the manufacturing areas.

2.3.2 Wood Preservative Formulation Area

The wood preservative formulation area is located in the west central portion of the Site. The main feature of this area is a 20 by 50-foot metal building located along the western property boundary. Wood preservative formulation involved mixing, blending and repackaging raw materials for distribution. Raw materials were purchased in 55-gallon drums, which were offloaded directly into the Wood Preservative Formulation Building. Blending, mixing and repackaging activities were conducted in the central portion of the building. Reportedly, a

2,000-gallon capacity above ground tank was located in this building. Wood preservatives that were mixed and repackaged included creosote, two copper compounds, and PCP/mineral spirit mixtures.

2.3.3 Other Operations Area

The other operational areas refer to the former Site operations conducted south of the wood preservative formulation area within and east of a large metal building (referred to as the Tar Manufacturing Building on Figure 2) that borders the western portion of the Site. Former Site features once located within this area included above ground asphalt and tar mixing tanks, underground saturators and above ground tanks. The building structures in the Other Operations Area were primarily used for storage of finished products and paper used for the manufacturing of roofing materials. The wooden building structure located in the southwestern portion of the property housed ATCO's administrative offices. The metal buildings were used for finished product and paper storage.

2.4 CURRENT SITE STATUS

All of the buildings discussed in Section 2.2 above are present at the Site today (as of the publication of this CAP) and are occupied by a variety of tenants. These tenants include companies involved in construction, carpentry/cabinet manufacture and boat repair. No known issues of environmental concern are associated with the present tenants.

2.5 PAST SITE ACTIVITIES OF ENVIRONMENTAL CONCERN

Past Facility operations (conducted by ATCO) included manufacturing of coal tar and asphalt-roofing products, and wood preservative product formulation. The raw materials used in the manufacturing and formulation processes were typically liquids of various viscosities. Hazardous chemicals within the raw materials include mineral spirits (primarily petroleum hydrocarbons and benzene, toluene, ethylbenzene and xylenes [BTEX]), PAHs, chlorinated solvents, and PCP. Liquid raw materials were delivered either by tanker truck or in 55-gallon drums.

Materials delivered in tanker trucks (primarily for manufacturing of coal tar and asphalt roofing products, not for wood preservative formulation) were offloaded into above ground tanks. From the above ground tanks these materials were conveyed through above ground pipelines to the manufacturing floor. Liquids for wood preservative formulation were received in 55-gallon drums. The drums were offloaded and stored in the metal building in the north central portion of the Site. These concentrated chemicals were mixed, blended and repackaged. Finished products were stored inside buildings within the Other Operations Area, pending sale and customer delivery/pickup.

Several of the surrounding properties also have past activities of environmental concern. A Chevron bulk fuel storage terminal operated on the property immediately to the west across Densmore Avenue North from 1926 until METRO purchased the property in 1982. Seven large

above ground tanks from the former Chevron tank farm remain. Hazardous chemicals associated with this Site are primarily petroleum hydrocarbons and BTEX, which are also associated with the NORTAR/former ATCO Site. Environmental remediation is being conducted at the METRO/former Chevron property.

Gas Works Park lies immediately to the south of the NORTAR/former ATCO Site, across North Northlake Avenue. The shoreline of Lake Union bounds Gas Works Park to the south. Seattle Gas & Light Company constructed and operated a coal gasification plant from 1906 to approximately 1956 at this location. Gas Works Park opened in 1976. Some of the raw materials used by ATCO were byproducts of activities at the coal gasification plant. Many of the hazardous materials associated with the Gas Works Park site are also associated with the NORTAR/former ATCO site including PAHs, petroleum hydrocarbons, BTEX, and chlorinated solvents. In addition, heavy metals are a concern at Gas Works Park. Remediation of environmental hazards is ongoing at Gas Works Park.

2.6 FUTURE SITE USE

The Site conceptual redevelopment plan assumes that the CAP is implemented through a Prospective Purchaser Agreement Consent Decree and that the associated Contract Rezone request is successful. The Site conceptual redevelopment plan is summarized below and a more detailed description is provided in Appendix A.

Triad Northlake LLC proposes to purchase the 1.3-acre Site, successfully obtain a Contract Rezone from IC 45' to C1/40' and construct a mixed-use residential/commercial development with related improvements. Approximately 107 residential units are proposed in conjunction with 13 live/work spaces and other commercial space. Underground parking that will include 170 stalls with access along Densmore Avenue North is proposed. Coincident with the redevelopment proposal, Triad North LLC proposes to remove existing warehouse structures, and implement a Cleanup Action Plan under a Prospective Purchaser Consent Decree, under the direction of the Washington Department of Ecology.

3.0 SITE CHARACTERIZATION ACTIVITIES

The following section presents a detailed chronology and overview of past environmental investigations pertaining to the NORTAR/Former ATCO facility.

3.1 CHRONOLOGY OF INVESTIGATIONS

Site characterization activities have included the completion of six environmental investigations from September 1986 to March 1998. In chronological order, Site characterization activities have included:

- A Soil Quality Evaluation conducted by Shannon and Wilson in 1986.
- A Groundwater Assessment conducted by Hart Crowser in 1990.
- A Supplemental Hydrogeologic Site Characterization conducted by SECOR in 1990.
- Groundwater Sampling conducted by SECOR in 1996.
- A Site Hazard Assessment conducted by the King County Health Department under contract to Ecology in 1997.
- A Supplemental Soil and Perched Formation Water Assessment conducted by Equipoise in 1998 (documentation of this assessment has been incorporated into the CAP).

Each of these Site characterization activities are further detailed in the following sections.

3.2 SHANNON AND WILSON

In September 1986 Shannon and Wilson conducted an investigation to assess the applicability of environmental regulations to the Site. Work tasks conducted and the results of the investigation are presented in Shannon and Wilson's report entitled, S*oil Quality Evaluation—ATCO Plant Report*, dated September 15, 1986.

During the investigation Shannon and Wilson completed three hollow-stem auger borings, B-1 to a depth of 18.5 feet below surface grade, B-2 to a depth of 10.5 feet below surface grade, and B-3 to a depth of 17.5 feet below surface grade. In addition, two hand auger borings (HB-1 and HB-2) were completed to a depth of 2 feet below surface grade. Boring locations are illustrated on Figure 3. Shannon and Wilson borings are indicated by the prefix SW.

Shannon and Wilson reported that two soil units underlie the Site. Near surface soil consist of dense to very dense, fine to medium grained, gravelly sand. This sand is underlain by very dense, silty, gravelly, fine sand. The contact between the gravelly sand and gravelly fine sand

was observed at a depth of 18 feet in B-1, nine feet in B-3, and two and one-half feet in B-2. Elevated organic vapor readings, as measured using a photoionization detector (PID), were observed in soil from both hand auger borings and to a depth of approximately 10 feet in B-1 and B–3. Elevated PID readings were not observed in B-2.

Groundwater was encountered at a depth of two feet in B-1, four and one-half feet in B-3. Groundwater was not encountered in B-2. Shannon and Wilson stated that:

> *"The silty, gravelly, fine sand which occurs at 9 feet in B-3 and at 18 feet in B-1 appears to act as a perching aquitard, a barrier to downward migration of the groundwater, which creates a perched formation water condition in the ground. It appears that any contaminants or chemicals in the shallow soil and/or groundwater at the Site would probable remain in perched formation water".*

Fifteen soil samples were submitted for chemical analysis. Three phases of analyses were run on select soil samples. The results from each analytical phase were used to assess whether additional testing was needed on a sample, and to define the required analyses. During the first phase select samples were analyzed for total and hydrocarbon oil and grease, xylenes, PCP and ignitability. Phase two included analyses for ethylbenzene, naphthalene and xylenes. Phase three included analyses for "polycyclic aromatic hydrocarbons". The analytical results presented in Shannon and Wilson's report indicated the following

- Total oil and grease was detected above the analytical method detection limit in nine of the 11 analyzed samples.
- Hydrocarbon oil and grease was detected above the analytical method detection limit in four of the 11 analyzed samples.
- Xylenes were detected above the analytical method detection limit in four of the seven analyzed samples.
- Ethylbenzene was detected above the analytical method detection limit in both of the analyzed samples.
- Naphthalene was detected above the analytical method detection limit in one of the two analyzed samples.
- PCP was detected above the analytical method detection limit in the analyzed sample.

3.3 HART CROWSER

In May 1990 Hart Crowser conducted a assessment of groundwater at the Site. The assessment methods and results are presented in Hart Crowser's report entitled, *American Tar Company Groundwater Assessment*, dated May 25, 1990. During their assessment Hart Crowser drilled, installed and sampled three groundwater monitoring wells (HC-1, HC-2 and HC-

3). Wells HC-1 and HC-2, both completed at a depth of approximately 25 feet below surface grade, were installed at the downslope (southern) property boundary along North Northlake Way. Well HC-3, completed at a depth of 14.5 feet below surface grade, was installed in a parking area in the east central portion of the Site. Well locations are illustrated on Figure 3 and designated as HC-MW-1, HC-MW-2 and HC-MW-3. Hart Crowser indicates that the approximate elevation above mean sea level of Wells HC-1 and HC-2, located along North Northlake Avenue, is 10 feet and that of Well HC-3, located in the east central portion of the property is 39 feet.

Hart Crowser defined the Site geology as consisting of an upper sand layer and lower till. The upper sand layer is described as, *…weathered, medium dense to dense, slightly gravelly silty sand.* This sand unit was reportedly encountered over the entire 14.5 feet in Well HC-3 and tapered to less than a few feet in thickness at the base of the hill at well locations HC-1 and HC-2. The lower till is described as, *…dense, slightly gravelly, silty sand.* Reportedly, the upper portions of the till were dry at the base of the hill, but became moist several feet below the top of the layer. Intermittent moist and damp layers were reportedly encountered during drilling. HartCrowser suggested that this indicated the relatively low permeability of the unit.

Groundwater was encountered in the central portion of the Site (Location HC-2) at 5.5 feet below surface grade. Groundwater was not observed in the upper sand unit at the base of the hill in Wells HC-1 or HC-2. The till, which HartCrowser suggests is of lower permeability relative to the upper sand unit, is saturated at depth although it was difficult to see "*free water*" during drilling. HartCrowser suggests that the lack of visible saturation is apparently because of the "*tight*" nature of the till.

Based on their assessment Hart Crowser made the following observations:

- *The Upper Sand groundwater at HC-3 is a localized perched zone, with unknown lateral continuity. Perched groundwaters are commonly seasonal.*

- *The Upper Sand groundwater might be channeled laterally in a direction away from the lower wells HC-1 and HC-2. In that case the groundwater could be discharged to the surface somewhere near the ATCO site.*

- *The Upper Sand groundwater might discharge vertically through slow leakage or through a higher permeability zone into the underlying till.*

Hart Crowser submitted groundwater samples from each installed well for chemical analysis. Concerning the analytical results Hart Crowser concluded the following:

- *The wells at the base of the hill and installed in the lower till (HC-1 and HC-2) contained no significant concentrations of VOCs, semivolatile organics or trace metals. This implies either that the ATCO facility has not affected the lower till groundwater, or that the contaminant plume in the lower till (if it exists) could flow in a direction not covered by wells HC-1 and HC-2.*

- *Well HC-3 (installed into the Upper Sand at the center of the Site) contained benzene, ethylbenzene, toluene and xylenes at concentrations higher than the proposed Model Toxics Control Act (MTCA) Method A Compliance Limit for residential groundwater. The benzene concentration also exceeded the MTCA Conditional Limit for non-residential groundwater. The ethylbenzene, toluene, and xylene concentrations were less than the Conditional non-residential limit.*

3.4 SECOR

In September 1990 SECOR conducted a hydrogeologic assessment at the Site. The objectives of their assessment were to "*expand on the data generated during the previous studies including determining the groundwater flow gradient and direction in the perched zone* and *further define the lateral extent of chemicals in shallow groundwater at the Site"*. Investigation methods and results are presented in SECOR's report entitled: *Supplemental Hydrogeologic Site Characterization Report*, dated September 15, 1990. During the assessment SECOR drilled, installed and sampled four 10 to 15 feet deep monitoring wells (MW-4 through MW-7). Well locations are illustrated on Figure 3 and designated as SEC-MW-4, SEC-MW-5, SEC-MW-6 and SEC-MW-7.

SECOR described the geology and hydrology of the Site as follows:

> *"The shallow geology beneath the Site includes a small fill zone (to a depth of approximately three feet) below the entrance road located on the northwestern portion of the property. Below the fill and consistent in the borings, was a mostly gray brown silty fine to medium sand with a relatively high percentage of medium subrounded gravel. The layer was generally saturated and dense. Below the shallow saturated zone was a very dense unsaturated silt, sand and gravel layer that is characteristic of the glacial tills in the area that were deposited during glacial and inter-glacial periods of the late Pleistocene Epoch. The shallow groundwater was found in the gray brown silty fine to medium sand layer between four and five feet below ground surface.*

SECOR presented a piezometric surface contour map for the shallow perched groundwater zone that depicted a groundwater movement direction toward the south-southeast. SECOR indicated that the hydraulic gradient across the Site appears to be *a relatively steep, subterranean reflection of topography* and that the perched groundwater in the upper zone appeared to be *laterally continuous*. SECOR noted that the groundwater piezometric flow lines do not dampen near the retaining wall that runs east west across the middle of the Site, which to them suggests that shallow groundwater is not influenced by the retaining wall. The recharge rates of groundwater in the monitoring wells were moderately slow. In general, SECOR concluded that the wells furthest north on the property produced more water than the southern wells. All of the wells were bailed dry during purging and required in excess of one half hour to recharge sufficiently to sample.

No soil samples were retained for laboratory analyses although SECOR noted that soil from two of the wells had olfactory evidence of impacts (likely MW-4 and -6, although the report says MW-5 and -7).

Groundwater samples obtained from the four installed wells (MW-4 through MW-7) were analyzed for benzene, toluene, ethylbenzene and xylenes (BTEX), and semivolatile organic compounds (SVOCs). In addition, the sample obtained from well MW-4 was analyzed for halogenated volatile organic compounds. Regarding the groundwater analytical results SECOR stated that:

> *"Groundwater from monitoring wells contains chemical constituents ethyl benzene, toluene, and xylene from monitoring wells MW-4 and MW-6, exceeding current draft Ecology cleanup levels. … The groundwater sample from monitoring well MW-6 also exceeded the draft Ecology level for benzene at 5 ppb, and pentachlorophenol at 30 ppb. No other compounds exceeded current Ecology draft levels".*

Regarding potential remediation strategies, SECOR noted that since current plans call for excavation at the Site and that since the perched groundwater zone will be removed during this excavation, groundwater remediation may not be required at the Site.

In July 1996, SECOR returned to the Site to obtain groundwater samples from wells MW-1 and MW-2 (located along North Northlake Way). The sample from each well was analyzed for gasoline range hydrocarbons, diesel through heavy oil range hydrocarbons and polyaromatic hydrocarbons. The results are presented in SECOR's letter report entitled *Groundwater Monitoring Well Sampling*, dated August 21, 1996. The analytical results presented by SECOR indicate that:

- Gasoline range hydrocarbons (including BTEX) were not detected above the analytical method detection limit

- The combined total of diesel through heavy oil range hydrocarbons detected exceeded the MTCA Method A cleanup standard of 1 milligram per kilogram (mg/kg)

- PCP (in MW-1) and naphthalene (in MW-2) were the only polyaromatic hydrocarbons detected. The detected concentration of naphthalene was well below the MTCA Method B cleanup levels (no Method A cleanup level is published). PCP was detected at a concentration that exceeded it's carcinogenic MTCA Method B cleanup level (the Method B non-carcinogenic cleanup level was not exceeded) but did not exceed the *Practical Quantitation Limit (PQL) established by Ecology of 4 ppb*.

3.5 KING COUNTY HEALTH DEPARTMENT

Under contract to the Washington State Department of Ecology, the King County Health Department (County) completed a Site Hazard Assessment (SHA) of the NORTAR/Former ATCO Site in June 1997. An SHA was conducted to confirm the presence of hazardous substances and to determine the relative risk the Site poses to human health and the environment. In

accordance with MTCA, Ecology used the SHA data to give a Hazard Ranking to the Site. Sites are ranked on a scale of 1 to 5; with a score of 1 representing the highest level of risk and 5 the lowest. The NORTAR/Former ATCO Site was given a ranking of 1.

During the SHA the County noted that no drinking water wells are located within a two-mile radius and the area is serviced by a sewer system. During soil sampling in the southwestern portion of the former tank farm approximately 2 feet north of the concrete retaining wall and 6 inches east of the asphalt covered culvert, petroleum stained water was encountered less than a foot from the surface. Ethylbenzene; m, p-xylene; o-Xylene, TPH as gasoline and TPH as diesel were all above MTCA Method A soil cleanup levels at 36, 120, 25, 1500 and 2700 ppm, respectively. Polyaromatic hydrocarbons including Benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene were also reportedly above cleanup standards at 71, 85, 45, 35, 65, 29, and 16 ppm, respectively. EPA classifies these 7 PAHs as carcinogens.

3.6 EQUIPOISE CORPORATION

Equipoise Corporation (Equipoise) conducted a supplementary soil and perched formation water assessment in March 1998. The supplementary assessment was conducted to meet the remedial investigation requirements as listed in Chapter 173-340-350 WAC. The objective of the soil and perched formation water assessment was to supplement previous Site characterization data, assess appropriate cleanup methods and estimate associated remediation costs. Equipoise conducted this work on behalf of a non-PLP that has expressed an interest in redeveloping the Site property, if the required remediation is not prohibitive.

3.6.1 Pre-Investigation Site Conceptual Model

Prior to conducting the field investigation a Site conceptual model was prepared. The model was prepared to guide the field investigation in terms of incorporating what was known about the environmentally relevant historical operations, the previously conducted environmental investigations, the proposed redevelopment, and the data gaps in the Site understanding. A summary of the pre-investigation conceptual model is provided below.

Since the underlying objective of the supplementary investigation was to make a prospective purchaser decision based on remedial cost estimates, the scope of additional investigative activities was designed to identify the worst case remedial cost estimate. With this objective in mind, it was important in the investigation to identify any contamination that might prove to be too costly for the prospective purchaser to remediate relative to the value of the property. Further, since the prospective purchaser's tentative plans for Site development include demolition and considerable excavation, it was important to assess the remedial options that are compatible with this approach from a technical and schedule perspective.

The pre-investigation hydrogeological Site conceptual model for the Site consists of an upper saturated zone with low transmissivity that ranges in depth between a few feet below surface grade on the northern and central portions of the Site. The thickness of this zone has been incompletely characterized, but was anticipated to be from a couple feet to 10 feet below

surface grade. It is anticipated that this zone is to be completely excavated during Site redevelopment. Therefore, the conceptual remedial plan made the identification of the different types and associated volumes of soil contamination requiring disposal the highest priority. If the volumes of impacted soil were sufficiently low, the conceptual remedial plan called for identifying the appropriate disposal transportation and disposal destination for the various contaminant types.

Under this scenario, addressing contamination within the upper perched formation water-bearing zone would be accomplished by removing sources of soil contamination through soil excavation and addressing potential disposal requirements for the associated water generated during excavation activities. It was considered possible that this water would need to be collected and treated/disposed. Water disposal options were to be determined in the investigation depending on the concentrations of various contaminants. No long-term groundwater remediation is expected due to the extensive excavations tentatively planned for redevelopment. The Site conceptual model considered that the entire upper water-bearing zone would be removed during Site development and clean water within the upper water-bearing zone upgradient of the Site (along the northern boundary) would be addressed through conventional Site drainage planning. Therefore, investigation activities focussed on finding all contaminant sources in Site soils through a comprehensive soil-sampling program. Some perched-water monitoring points were planned to enable the anticipation of any required excavation water treatment and disposal requirements. These new monitoring points were also to be used to identify any newly encountered impacts to perched formation water that may provide an indication of nearby contaminant source areas. In addition, all existing wells (or one-time-only groundwater sampling in the vicinity of existing wells) were to be sampled.

3.6.2 Summary of Previous Sampling Activities

In order to assess Site conditions relative to potential impacts from hazardous chemicals in soil and perched formation water in the defined Operation Areas, a comparison of the constituents detected during previous environmental sampling activities and their reported concentrations versus current MTCA cleanup levels was made. The comparison for each of the operations areas is described in the following sections.

3.6.2.1 Wood Preservative Formulation Area

Previous Site characterization activities within the Wood Preservative Formulation Area included the completion of one auger boring (SW-B-3), and the installation of one perched formation water monitoring well (SEC-MW-6). A comparison of sampling results versus current MTCA cleanup levels reveals that no soil constituents analyzed exceeded their MTCA Cleanup levels. The sample of perched formation water obtained from well SEC-MW-6 exceeded the:

- MTCA Method A and Method B groundwater cleanup levels for benzene.
- MTCA Method A groundwater cleanup level for toluene.
- MTCA Method A and Method B groundwater cleanup levels, and the MTCA surface water cleanup level for ethylbenzene.

- MTCA Method A groundwater cleanup level for xylenes.

- MTCA Method B groundwater cleanup level for naphthalene.

- MTCA Method B carcinogenic groundwater cleanup level and MTCA carcinogenic surface water cleanup level for PCP.

3.6.2.2 Former Tank Farm Area

Previous Site characterization activities within the Former Tank Farm Area included the completion of two hand auger borings (SW-HB-1 and SW-HB-2) and one auger boring (SW-B-1), and the installation of two perched formation water monitoring wells (SEC-MW-4 and SEC-MW-5). A comparison of sampling results versus current MTCA cleanup levels reveals the following:

- Total hydrocarbons as oil and grease were detected in soil from HB-2 at 1.3 feet below surface grade above the MTCA Method A cleanup level for total petroleum hydrocarbons (TPH.

- Ethylbenzene and xylenes were detected in soil above their respective MTCA Method A cleanup levels in soil from HB-2 at a depth of 2 feet below surface grade and SW-B-1 at 4 to 4.5 feet below surface grade.

- A sample of perched formation water obtained from well SEC-MW-4 exceeded the MTCA Method A and Method B groundwater cleanup levels for toluene.

- A sample of perched formation water obtained from well SEC-MW-4 exceeded the MTCA Method A and Method B groundwater cleanup levels, and the MTCA surface water cleanup level for ethylbenzene.

- A sample of perched formation water obtained from well SEC-MW-4 exceeded the MTCA Method A groundwater cleanup level for xylenes.

3.6.2.3 Other Operations Area

Previous Site characterization activities within the Other Operations Area included the completion one auger boring (SW-B-2), the installation of two perched formation water monitoring wells (HC-MW-3 and SEC-MW-7), and the installation of two groundwater monitoring wells (HC-MW-1 and HC-MW-2). A comparison of sampling results versus current MTCA Cleanup levels reveals that no soil constituents analyzed exceeded their MTCA Cleanup levels. A comparison of sampling results versus current MTCA cleanup levels reveals the following

- A sample of perched formation water obtained from well HC-MW-3 exceeded the MTCA Method A and Method B groundwater cleanup level for benzene.

- A sample of perched formation water obtained from well HC-MW-3 exceeded the MTCA Method A groundwater cleanup levels for toluene, ethylbenzene and xylenes.

- Groundwater samples obtained from wells HC-MW-1 and HC-MW-2 exceeded the MTCA Method A groundwater cleanup level for TPH.

- A groundwater sample obtained from well HC-MW-1 exceeded the MTCA Method B carcinogenic groundwater cleanup level for PCP.

3.6.3 Investigation Approach

The pre-investigation Site conceptual geologic and hydrogeologic model and previous environmental sampling data were utilized to develop an investigation strategy. The strategy differed slightly for each operation area based on the potential for area specific contaminant sources. These different potential contaminant sources necessitated area specific investigation approaches and data objectives. These different data objectives translated into different analytical strategies and sampling densities in order to assess potential contaminant source areas in each of the three Site operation areas. Since Triad (a non-PLP) was interested in redeveloping the Site if remediation requirements were not prohibitive, Equipoise's investigation proceeded in a phased approach starting in what was considered to be the worst case (i.e., highest risk and most costly relative to remediation) area of potential contamination. This approach allowed for a series of decision points where Triad could continue or abort the investigation. Upon completion of the investigation in particular areas of potential contamination, Triad was able to determine whether potential remediation costs would exceed their assessment of the property/redevelopment value. As it turned out, the investigation proceeded to completion because Triad did not see the anticipated volume of contamination as cost prohibitive to redevelopment.

During this assessment, additional Site data was obtained by collecting and analyzing soil samples from 27 Strataprobe™ borings (SP1 through SP11, SP16, SP20, SP21, SP22, SP24 through SP30, SP32, and SP37 through SP40) and 10 hand borings (SP13, SP14, SP15, SP17, SP18, SP19, SP35, SP36, SP41 and SP42). Perched formation water data was obtained by completing and obtaining perched formation water samples from 5 Strataprobe™ borings (SP12, SP23, SP31, SP33 and SP34). Boring locations are illustrated on Figure 4. The target depth for each soil boring was 10 to 12 feet below surface grade. Sixteen of Strataprobe™ borings reached the target depth. Nine Strataprobe™ borings (SP4, SP5, SP8, SP11, SP20, SP24, SP32, SP39, and SP40) met with refusal on very dense till from 8 to 9.5 feet below surface grade; SP37 met refusal at a depth of 7 feet, and SP38 at a depth of 4.5 feet. One hand boring (SP17) reached the target depth. Hand boring SP18 met refusal at 9.5 feet below surface grade, SP19 met refusal at a depth of 7 feet, SP13 through SP15 and SP42 met refusal between 3 to 4 feet below surface grade, and SP41 at a depth of 1.5 feet. Upon completion of sampling activities at a given location the boring was abandoned by backfilling with bentonite chips. The bentonite chips were hydrated with potable water.

During Equipoise's assessment a total of 116 soil and 8 perched formation water samples were submitted for chemical analysis. Analytical services were provided on-Site by a mobile laboratory and at a fixed based laboratory. A mobile laboratory was on-Site during field

activities. The mobile laboratory was utilized to provide rapid turn-around, accurate, field screening chemical analysis data. Select samples from the borings were analyzed in the field by the mobile laboratory for:

- Hydrocarbon Identification by Ecology Method NWTPH-HCID.
- PAHs by EPA Method 8100.
- PCP by EPA Method 8040.

These analytical methods were selected for the following reasons:

- HCID analysis allowed for a rapid determination of whether a specific target range(s) of hydrocarbons were present. The results were used to assist in the selection of samples to be submitted for confirmation analysis of purgeable volatile aromatics.
- PAHs and PCP, represent the highest risk for Triad relative to remediation (soil disposal costs).
- The preparation and analysis time on a per sample basis is less, relative to other methods that include the same analytes, allowing for many more samples to be analyzed.
- The methods of PAH (EPA 8100) and PCP (EPA 8040) analysis, are less discriminating, relative to other methods that may be used for similar analytes, and therefore the results are considered conservative. Both of the methods used are GC (gas chromatograph) methods. In a GC analytical method the total area under a peak on the chromatogram at a specific elution time is used to calculate the total concentration for the analyte (e.g., PCP) that according to the method is associated with that elution time. In reality there may be several compounds that elute at or very near the same time. This may lead to reporting a higher concentration for an analyte when in reality there are several compounds present. To separate the compounds under a specific peak an analytical method that utilizes an MS (mass spectrometer, e.g. EPA 8270) detector is more accurate as compounds can be differentiated by mass. Due to the added time that is required, as well as significant additional cost, analysis by a GC/MS method was not deemed practicable for the mobile laboratory. A GC/MS method was used to analyze confirmation samples at a fixed-base laboratory.

Confirmation samples were submitted to a fixed-base laboratory. Samples were selectively analyzed for:

- Purgeable Volatile Aromatics (BTEX) by EPA Method 8020.
- Chlorinated Hydrocarbons by EPA Method 8010.
- Semivolatile Organic Compounds (SVOCs) by EPA Method 8270. EPA Method 8270 is a GC/MS analytical method that includes the same analytes as EPA Method 8100 (PAHs)

and Method 8040 (PCP). Based on Equipoise's discussions with the analytical laboratories regarding the coelution of compounds, Methods 8100 and 8040, respectively, (discussed above in the fourth bullet item under reasons for the selection of mobile laboratory analytical methods) may bias PAHs and PCP concentrations high. Therefore the results of analysis by EPA 8270 will be given greater weight when discussing the laboratory results for these compounds. This reasoning has been discussed with and agreed upon by Ecology (verbal communication with Ms. Maura O'Brien).

- Toxicity Characteristic Leaching Procedure (TCLP) SVOCs by EPA Method 1311/8270.
- Select metals by EPA Method 6010, 6020 and 7421.
- 96-Hour Acute Bioassay by Ecology Biological Testing Methods 80-12 for the designation of dangerous waste.

A complete list of the samples submitted and analyses conducted are provided on Table 1. Boring and mobile analytical services were provided by Transglobal Environmental Geosciences Northwest, Incorporated (TEG). Confirmation samples analyzed by TEG and North Creek Analytical (NCA), at their fixed-based analytical laboratories. TEG and NCA are both Washington State certified for the analyses they conducted. All soil and perched formation water samples were obtained, handled and analyzed in accordance with industry, Washington State, and/or United States Environmental Protection Agency (EPA) protocol, guidelines and standards.

Investigation activities conducted in each Site operation area are provided below.

3.6.3.1 Wood Preservative Formulation Area

Equipoise's supplementary investigation began in the Wood Preservative Formulation Area. This was due to the feeling that PCP represented the highest risk relative to remediation. Triad felt that if widespread PCP was present in the Wood Preservation Formulation Area, they would not be prepared to continue with purchase and redevelopment of the property.

Field investigation activities in the Wood Preservative Formulation Area consisted of completing 19 Strataprobe™ borings (SP1 through SP19). From the 19 borings, 65 soil samples and 2 perched formation water samples were submitted for the following chemical analyses:

- Twenty-one soil samples were analyzed for hydrocarbon identification.
- Twenty-five soil samples and 2 perched formation water samples were analyzed for chlorinated hydrocarbons and BTEX.
- Fifty-five soil samples and 2 perched formation water samples were analyzed for PAHs and PCP.
- Twelve soil samples were analyzed for SVOCs.

- Two soil samples were analyzed for TCLP SVOCs.
- One soil sample was analyzed for select metals.
- Two soil samples were analyzed for 96-hour acute bioassay.

3.6.3.2 Former Tank Farm Area

After the Wood Preservative Formulation Area Equipoise's supplementary investigation moved to the Former Tank Farm Area. Previous Site characterization activities within the Former Tank Farm area have indicated the presence of oil, benzene and xylenes in soil and toluene, ethylbenzene and xylenes in perched formation water above MTCA Cleanup levels. Based on historic activities PAHs, and in particular carcinogenic PAHs are considered to be constituents of potential concern at the Tank Farm Area. Based on Equipoise's review we felt that previous sampling for PAHs was insufficient to characterize the potential risk, specifically as it relates to potentially restrictive and costly disposal requirements. Therefore, a sampling program to assess the presence/absence and concentration of PAHs and, if present, the volume of impacted soil requiring remediation was designed. In particular, it was important to assess carcinogenic PAH impacts. The sampling and analytical strategy implemented for the Former Tank Farm Area reflects these issues.

Field investigation activities at the Former Tank Farm Area consisted of completing 10 Strataprobe™ borings (SP21 through SP30). From the 10 borings 27 soil samples and 1 perched formation water sample were submitted for the following chemical analyses:

- Two soil samples and one perched formation water sample were analyzed for chlorinated hydrocarbons and BTEX.
- Twenty-four soil samples and one perched formation water sample were analyzed for PAHs and PCP.
- One soil sample was analyzed for select metals.

3.6.3.3 Other Operations Area

Previous Site characterization in the Other Operations Area has been very limited. Equipoise had two main objectives in assessing the Other Operations Area. The first was to supplement previously obtained soil and perched formation water data by generally assessing the presence or absence of PAHs and PCP within the Other Operations Area. Second was to obtain soil and perched formation water data in the down topography and down gradient (relative to the anticipated perched formation water movement direction assuming there was sufficient head and water present) direction.

Field investigation activities at the Other Operations Area consisted of completing 13 Strataprobe™ borings (SP20 and SP31 through SP42). From the 13 borings, 23 soil samples and 5 perched formation water samples were submitted for PAHs and PCP analyses.

3.6.4 Geologic and Hydrogeologic Conditions

Subsurface geologic and hydrogeologic conditions observed by Equipoise during our supplemental assessment investigation were similar to those reported by others during previous Site characterization activities. In general, the typical subsurface profile consists of medium dense, weathered till underlain by dense to very dense till. Locally areas of fill were observed. Fill consisted of loose sand. At locations SP10 and SP17 fill material to a depth of 10 feet was observed. This fill is thought to be associated with the retaining wall located immediately to the south. At locations SP21, SP22, SP23 and SP29 fill was observed to a depth of 3 to 4 feet. Immediately underlying the fill at each of these locations concrete, thought to be a former driveway, was encountered. Beneath the concrete approximately 6 inches of gravel "road base" was observed.

The medium dense weathered till reaches a thickness of up to 8 feet, along the northern (upslope) portion of the property. The unit thins southward (downslope) toward North Northlake Way, where the thickness of the weathered till unit is approximately 2 feet. The till varies both laterally and vertically and is composed of varying percentages of silt, sand and gravel. Locally within the weathered till there appear to be sand and gravel lenses (i.e., areas with a higher percentage of sand and gravel relative to the surrounding formation). Underlying the weathered till is a dense to very dense till composed of varying percentages of silt, sand and gravel. The weathered till and till are very similar in composition; the main difference being that the till is very dense and appears to contain a bit higher percentage of silt relative to the overlying weathered till.

Perched formation water was encountered in the weathered till unit in each of the Strataprobe™ borings. During Equipoise's assessment perched formation water was observed at the weathered till and till interface and in sand and/or gravel lenses within the weathered till. The perched formation water observed at the weathered till – till interface appears to be associated with differences in densities between the two units. This difference in density causes a difference in the transmissivity/permeability between the two units, with the underlying till being less transmissive and less permeable. This is manifested by the presence of water perched at the weathered till – till interface during times when excess formation water migrates through the weathered till faster than the formation water can migrate through the till. The depth at which perched formation water was encountered during field activities varied from approximately 2 to 7 feet below surface grade. The depth to perched formation water at the weathered till – till interface typically became shallower from north to south as the weathered till unit thinned and hence the weathered till – till contact became shallower.

At borings locations SP1, SP22, SP25 and SP26 perched formation water was observed in sand and gravel lenses as well as at the weathered till – till interface. Again Equipoise believes this to be an expression of the transmissivity/permeability difference in the lenses relative to the surrounding weathered till.

The perched formation water conditions observed by Equipoise differ slightly with those reported during previous Site characterization activities where perched formation water was reported to exist locally. Equipoise believes our observations, and that reported by others, is

accurate. Several, in fact all but one, of the previous investigations were completed in what is typically thought of as the dry season in Seattle (July through September). We believe the different observations relative to the presence and depth of perched formation water may be attributed to the seasonal variation in rainfall.

3.6.5 Analytical Laboratory Results

Analytical laboratory results are summarized on Tables 2 through 8. The analytical laboratory reports are presented in Appendix B. Soil sample analytical results for each Site Operation Area is provided below. Perched formation water sample results are summarized separately.

3.6.5.1 Wood Preservative Formulation Area

Sixty-five soil samples were submitted for analysis from borings completed in the Wood Preservative Formulation Area. The analytical results indicate the following:

- Hydrocarbons were detected in10 of the 21 samples analyzed (Table 2).

- Benzene was detected in 2 of the 25 analyzed samples. None of the detected concentrations exceeded the MTCA Method A or B cleanup levels of 0.5 milligrams per kilogram (mg/kg) and 34.5 mg/kg, respectively (Table 3).

- Toluene was detected in 14 of the 25 analyzed samples. The MTCA Method A cleanup level of 40 mg/kg was exceeded in one sample (SP4 from 1 to 4 feet). The detected concentration did not exceed the MTCA Method B cleanup level of 16,000 mg/kg (Table 3).

- Ethylbenzene was detected in 23 of the 25 analyzed samples. The MTCA Method A cleanup level of 20 mg/kg was exceeded in 8 samples. The MTCA Method B cleanup level of 8,000 mg/kg was not exceeded in any of the samples (Table 3).

- Total xylenes were detected in 24 of the 25 analyzed samples. The MTCA Method A cleanup level of 20 mg/kg was exceeded in 11 samples. The MTCA Method B cleanup level of 160,000 mg/kg was not exceeded in any of the samples (Table 3).

- The following chlorinated hydrocarbons were detected; vinyl chloride, cis-1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene and, tetrachloroethene. The MTCA Method A cleanup level for tetrachloroethene of 0.5 mg/kg was exceeded in five samples. The MTCA Method B cleanup level for tetrachloroethene of 800 mg/kg was not exceeded in any of the samples. The MTCA Method B cleanup level for vinyl chloride of 0.526 mg/kg was exceeded in one sample (SP4 from 1 to 4 feet)(Table 4).

- One or more PAHs were detected in 37 of the 55 analyzed soil samples. Of the PAHs detected only the carcinogenic PAHs exceeded their individual MTCA Method B soil cleanup level of 0.137 mg/kg. The MTCA Method B soil cleanup level of 1 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 29 of 55 samples analyzed by EPA Method 8100 and 12 of 12 samples analyzed by EPA Method 8270. The MTCA Method B

industrial soil cleanup level of 20 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 13 of 55 samples analyzed by EPA Method 8100 and 6 of 12 samples analyzed by EPA Method 8270 (Tables 5 and 6). A comparison of detected PAH concentrations by analytical method (i.e., EPA 8270 versus EPA 8100) is provided on Table 9. The comparison indicates that even though the detected concentration of a given PAH varies depending on the analytical method if the total carcinogenic PAH concentration exceeds the MTCA Method B soil cleanup level by EPA 8270 it also exceeds it by EPA 8100.

- PCP was detected in 21 of 55 soil samples analyzed by EPA Method 8040 (Table 5). The MTCA Method B carcinogenic soil cleanup level of 8.33 mg/kg was exceeded in 18 of the samples. PCP was detected in 1 of 12 soil samples analyzed by EPA Method 8270 (Table 6). The MTCA Method B carcinogenic soil cleanup level was exceeded in the sample (SP4 from 1 to 4 feet). A comparison of detected PCP concentrations by analytical method is provided on Table 9. The comparison indicates a significant reduction in PCP concentrations for the more accurate EPA Method 8270 (GC/MS) relative to EPA 8040 (GC). Based on Equipoise's discussions with TEG and NCA the reduction in PCP concentration is not unexpected and is due to the coelution of compounds, which leads to a biased higher concentration of PCP by EPA Method 8040.

- In the two samples analyzed for TCLP SVOCs the only detected compound was PCP (SP4 from 1 to 4 feet). The detected concentration was well below the dangerous waste threshold of 100 milligrams per liter [mg/l, published in the Dangerous Waste Regulations Chapter 173-303-090(8)(c) WAC] (Table 7).

- None of the detected metals concentrations exceeded their respective MTCA Method A and/or B soil cleanup levels (Table 8).

3.6.5.2 Former Tank Farm

Twenty-nine soil samples were submitted for analysis from borings completed in the Former Tank Farm Area. The analytical results indicate the following:

- Benzene and toluene were detected in 1 of the 2 analyzed samples (SP25 from 1 to 4 feet). The detected concentrations exceeded the MTCA Method A soil cleanup levels of 0.5 mg/kg and 40 mg/kg, respectively. The detected concentrations did not exceed their respective MTCA Method B soil cleanup levels (Table 3).

- Ethylbenzene and total xylenes were detected in both of the analyzed samples. The MTCA Method A cleanup level of 20 mg/kg was exceeded in 1 sample (SP25 from 1 to 4 feet). The ethylbenzene and xylenes concentrations did not exceed their respective MTCA Method B cleanup levels (Table 3).

- Tetrachloroethene was detected in both of the analyzed samples. The detected concentrations did not exceed the MTCA Method A or B cleanup level 0.5 mg/kg and 800 mg/kg, respectively (Table 4).

- One or more PAHs were detected in 18 of the 24 analyzed soil samples. Of the PAHs detected only the carcinogenic PAHs exceeded their individual MTCA Method B soil cleanup level of 0.137 mg/kg. The MTCA Method B soil cleanup level of 1 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 10 samples. The MTCA Method B industrial soil cleanup level of 20 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 5 samples (Table 5).

- PCP was not detected above the analytical method detection limit in any of the 24 soil samples analyzed (Table 5).

- None of the detected metals concentrations exceeded their respective MTCA Method A and/or B cleanup levels (Table 8).

3.6.5.3 Other Operations Area

Twenty-four soil samples were submitted for analysis from borings completed in the Other Operations Area. The analytical results indicate the following:

- One or more PAHs were detected in 13 of the 23 analyzed soil samples. Of the PAHs detected, only the carcinogenic PAHs exceeded their individual MTCA Method B soil cleanup level of 0.137 mg/kg. The MTCA Method B soil cleanup level of 1 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 7 samples. The MTCA Method B industrial soil cleanup level of 20 mg/kg for the seven carcinogenic PAHs as a group was exceeded in 2 samples (Table 5).

- PCP was not detected above the analytical method detection limit in any of the 23 soil samples analyzed (Table 5).

- None of the detected metals concentrations exceeded their respective MTCA Method A and/or B cleanup levels (Table 8).

3.6.5.4 Perched formation water Samples

Perched formation water samples were obtained from 8 Strataprobe™ boring locations; 2 borings (SP10 and SP12) were located within the Wood Preservative Formulation Area, 1 boring (SP23 was located within the Former Tank Farm Area, and five borings (SP31, SP33, SP34, SP37 and SP40) were located within the Other Operations Area. The analytical results summarized on Tables 3, 4 and 5 indicate that:

- The sample of perched formation water obtained from SP10 exceeds the MTCA Method A and B groundwater cleanup level for benzene, and the MTCA Method A groundwater cleanup level for total xylenes. Other analytes detected at a concentration less than their respective MTCA Method A or B groundwater cleanup levels include toluene, ethylbenzene, and tetrachloroethene. No PAHs or PCP were detected above the analytical method detection limits.

- The sample of perched formation water obtained from SP12 exceeds the MTCA Method A and B groundwater cleanup levels for benzene and ethylbenzene; the MTCA Method A groundwater cleanup level for toluene and total xylenes; and the Method B groundwater cleanup level for naphthalene. Tetrachloroethene was detected at a concentration less than its MTCA Method A or B groundwater cleanup level. PCP was not detected above the analytical method detection limit.

- The sample of perched formation water obtained from SP23 exceeds the MTCA Method A groundwater cleanup level for ethylbenzene, total xylenes, and vinyl chloride. Other analytes detected at a concentration less than their respective MTCA Method A or B groundwater cleanup levels include toluene, tetrachloroethene, and naphthalene. PCP was not detected above the analytical method detection limit.

- No PAHs or PCP were detected above the analytical method detection limits in the perched formation water samples obtained from SP31, SP33, SP34, SP37 and SP40.

4.0 SUMMARY OF ENVIRONMENTAL ISSUES

4.1 CONSTITUENTS OF POTENTIAL CONCERN

Data collected and presented in previous sections, has demonstrated the presence of the following constituents in various media at the Site:

- Petroleum hydrocarbons
- BTEX
- Chlorinated hydrocarbons including, vinyl chloride, cis-1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene and, tetrachloroethene
- PAHs
- PCP
- Metals including, arsenic, barium, cadmium, chromium, copper, lead, and zinc

Elevated levels of some of these constituents may warrant further consideration as constituents of concern (chemicals of concern) to be addressed during remedial actions. MTCA Method A and B soil and groundwater cleanup levels and MTCA Method B surface water cleanup levels have been used in this discussion to provide a basis for relative comparison of Site impacts, and to identify threshold, or action levels. Based on these action levels, constituents previously detected at the Site may be retained or eliminated from further consideration and cleanup action. Constituents of concern identified in this section will be retained and considered in the development of cleanup standards in subsequent sections.

4.1.1 Petroleum Hydrocarbons

Hydrocarbons as oil and grease were detected above the MTCA Method A total petroleum hydrocarbons (TPH) soil cleanup level in one historical sample (SW-B-1 at 2 feet). Soil samples obtained during Equipoise's assessment also detected the presence of hydrocarbons in shallow soil. In all but one location during the Equipoise assessment, soil sample hydrocarbon analyses indicate that impacts do not extend to the deeper horizons sampled. The one possible exception occurred at SP9 where the deeper soil horizons were not analyzed. The MTCA Method A groundwater cleanup level for TPH was exceeded in groundwater samples obtained from MW-1 and MW-2 in 1996. These data support the retention of TPH as a potential constituent of concern.

4.1.2 BTEX

Site characterization data for soil indicate the MTCA Method A soil cleanup level for toluene, ethylbenzene and xylenes was exceeded in several samples. The MTCA Method B soil cleanup level was not exceeded for benzene, toluene, ethylbenzene or total xylenes in any samples. The MTCA Method A or B groundwater cleanup levels for benzene, toluene, ethylbenzene or total xylenes were exceeded in perched formation water samples obtained from HC-3, MW-4, MW-6, SP10, SP12 and SP23. Based on these Site characterization data BTEX will be retained as potential constituents of concern.

4.1.3 Chlorinated Hydrocarbons

Site characterization data for soil indicate the MTCA Method A soil cleanup level for tetrachloroethene was exceeded in five samples from three borings (SP4, SP9 and SP14), the MTCA Method B cleanup level was not exceeded in any of these samples. The MTCA Method B soil cleanup level for vinyl chloride was exceeded in one sample (SP4 from 1 to 4 feet). The MTCA Method A groundwater cleanup level for vinyl chloride was exceeded in the perched formation water sample obtained from SP23. Based on these Site characterization data the chlorinated hydrocarbons, tetrachloroethene and vinyl chloride will be retained as potential constituents of concern. All other chlorinated hydrocarbons will not be retained.

4.1.4 PAHs

Site characterization data for soil indicate the MTCA Method B cleanup level for each carcinogenic PAH [benzo(a)anthrecene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene,and indeno(1,2,3-cd)pyrene] was exceeded in several samples. In addition, the MTCA Method A soil and industrial soil cleanup levels for carcinogenic PAHs as a group were exceeded. The MTCA Method B groundwater cleanup level for naphthalene was exceeded in the perched formation water samples obtained from MW-6 and SP12. No carcinogenic PAHs were detected above the analytical method detection limits in any of the eight perched formation water samples analyzed. Based on these Site characterization data carcinogenic PAHs in soil will be retained as a potential constituent of concern. Carcinogenic PAHs in perched formation water will not be retained. Naphthalene will be retained as a potential constituent of concern for perched formation water.

4.1.5 PCP

Site characterization data for soil indicate the MTCA Method B cleanup level for PCP was exceeded in one sample (SP4 from 1 to 4 feet). PCP was detected above the MTCA Method B cleanup level for groundwater in the perched formation water sample obtained from MW-6 in 1990. PCP was not detected above the analytical method detection limits in any of the eight perched formation water samples analyzed during Equipoise's assessment in 1998. Based on these Site characterization data PCP in soil will be retained as a potential constituent of concern. PCP in perched formation water will not be retained.

4.1.6 Metals

Site characterization data indicate that no metals were detected at a concentration above their respective MTCA Method A or B cleanup levels. No metals have been retained as constituents of concern.

4.2 MEDIA OF POTENTIAL CONCERN

4.2.1 Soil

Results of Site characterization activities have indicated the presence of TPH, vinyl chloride, carcinogenic PAHs and PCP in unsaturated soil at the Site. Soil has been retained as a potential medium of concern.

4.2.2 Perched formation water

Results of Site characterization activities have indicated the presence of BTEX, vinyl chloride and, naphthalene in perched formation water at the Site. Perched formation water has been retained as a potential medium of concern.

4.2.3 Groundwater

Results of one groundwater-sampling event in 1996 indicated the presence of diesel range and heavy oil range hydrocarbons in Wells MW-1 and MW-2. In each well, the combined total of TPH (i.e., diesel plus heavy oil ranges) slightly exceeded the MTCA Method A cleanup level of 1 mg/l. The detected concentration of each range did not exceed the MTCA Method A cleanup level. Soil samples obtained during Equipoise's assessment detected the presence of TPH in shallow soil. In all but one location, soil samples obtained from a deeper horizon did not indicate the presence of TPH (i.e., TPH was not present above the analytical method detection limit). In the one case, (SP9), deeper soil was not analyzed. These data indicate that the source of TPH detected in 1996 in MW-1 and MW-2 is not likely related to Site activities. Even so, groundwater has been retained as a potential medium of concern.

4.3 DISTRIBUTION OF POTENTIAL CONSTITUENTS OF CONCERN

4.3.1 Soil

TPH, BTEX, tetrachloroethene, vinyl chloride, carcinogenic PAHs, and PCP have been retained as potential constituents of concern in soil. A summary of each of the potential constituents of concern's distribution in soil follows.

- TPH in excess of the MTCA Method A soil cleanup level was detected in one sample obtained from SW-HB-2 at 2 feet below surface grade (Figure 3; boring completed by Shannon & Wilson in 1986 at the Former Tank Farm).

- Benzene was not detected in any samples above the MTCA Method A soil cleanup level.

- Toluene in excess of the MTCA Method A soil cleanup level was detected in one sample obtained from SP4 at 1 to 4 feet below surface grade. The MTCA Method B soil cleanup level was not exceeded.

- Ethylbenzene and xylenes in excess if their MTCA Method A soil cleanup levels were detected in samples obtained from borings SP2, SP3, SP4, SP5, SP9 and, SP14 all located in or in the immediate vicinity of the Wood Preservative Formulation Building (Figure 4). The MTCA Method B soil cleanup levels were not exceeded.

- Tetrachloroethene in excess of the MTCA Method A soil cleanup level was detected at three borings (SP4, SP9 and SP14) all located in or in the immediate vicinity of the Wood Preservative Formulation Building (Figure 4). The MTCA Method B soil cleanup level was not exceeded.

- Vinyl chloride in excess of the MTCA Method B soil cleanup level was detected in one sample obtained from SP4 at a depth from 1 to 4 feet below surface grade (completed in the Wood Preservative Formulation Building).

- Carcinogenic PAHs in excess of the MTCA Method A cleanup level were detected in samples obtained from borings completed in all three of the Operation Areas. The estimated lateral extent of carcinogenic PAHs in excess of 1 mg/kg (the MTCA Method A soil cleanup level) is illustrated on Figure 5.

- PCP in excess of the MTCA Method B carcinogenic soil cleanup level was detected in one sample obtained from SP4 at a depth from 1 to 4 feet below surface grade (completed in the Wood Preservative Formulation Building). The estimated lateral distribution of PCPs in excess of 8.33 mg/kg (the MTCA Method B carcinogenic soil cleanup level) is quite limited as illustrated on Figure 6.

4.3.2 Perched formation water

BTEX, vinyl chloride and, naphthalene have been retained as potential constituents of concern in perched formation water at the Site. A summary of each of the potential constituents of concern's distribution in perched formation water follows. Refer to Figures 3 and 4 for well/boring locations. Perched formation water sample analytical results are provided in Tables 3, 4 and 5.

- Benzene was detected in excess of MTCA Method A and B groundwater cleanup levels in perched formation water samples obtained from HC-3 (sampled by Hart Crowser in 1990) and SP10 and SP12 (sampled by Equipoise in 1998).

- Toluene was detected in excess of the MTCA Method A groundwater cleanup level in perched formation water samples obtained from HC-3, MW-4 and MW-6 (sampled by SECOR in 1990), and SP12. The concentration detected at MW-4 also exceeded the MTCA Method B cleanup level.

- Ethylbenzene was detected in excess of MTCA Method A groundwater cleanup level in perched formation water samples obtained from HC-3, MW-4, MW-6, SP12 and SP23. The concentration detected at SP12 also exceeded the MTCA Method B groundwater cleanup level. The concentrations detected at MW-4 and MW-6 also exceeded the MTCA Method B groundwater and surface water cleanup levels.

- Total xylenes were detected in excess of the MTCA Method A groundwater cleanup level in perched formation water samples obtained from HC-3, MW-4, MW-6, SP10, SP12 and SP23.

- Vinyl chloride was detected in excess of the MTCA Method A and B groundwater cleanup levels and MTCA Method B surface water cleanup level in a perched formation water sample obtained from SP23.

- Naphthalene was detected in excess of the MTCA Method B groundwater cleanup level in a perched formation water sample obtained from SP12. No carcinogenic PAHs were detected above the analytical method detection limits in any of the perched formation water samples analyzed.

- PCP was detected above the MTCA Method B cleanup level for groundwater in the perched formation water sample obtained from MW-6 in 1990. PCP was not detected above the analytical method detection limits in any of the eight perched formation water samples analyzed during Equipoise's assessment in 1998

4.3.3 Groundwater

The only potential constituent of concern that has been detected in groundwater is TPH. TPH was detected above the MTCA Method A groundwater cleanup level in samples obtained from Wells MW-1 and MW-2 in 1996.

4.4 CONTAMINANT CHEMISTRY AND ENVIRONMENTAL FATE

The potential contaminants of concern that have been identified at the Site included TPH, vinyl chloride, BTEX, PAHs and phenolic compounds (PCP). Some relevant information on the chemistry and environmental fate of BTEX, PAHs and phenolic compounds is described in the following sections. Since TPH and vinyl chloride were not widely observed in soil and perched formation water at the Site these compounds are not included in this discussion, however they will be monitored in the Compliance Monitoring at the completion of the cleanup actions (see Section 8 below).

4.4.1 BTEX

BTEX and other volatile organic compounds are typically much more mobile than either the PAHs or phenolic compounds. BTEX have relatively high water solubility and volatility, and they are only weakly to moderately adsorbed by soil. The degree of soil adsorption will be influenced by the fraction of organic carbon present in the soil. Benzene is the most mobile. A significant fraction of these compounds can be expected to volatilize from surface soils. The remainder can be expected to leach toward and within perched formation water.

4.4.2 PAHs

Polynuclear aromatic hydrocarbons (PAHs) are relatively large molecules with low volatility and low water solubility. They typically adhere strongly to soil. Consequently, these compounds can be expected to be quite immobile in the environment, leaching from soil into the perched formation water very slowly, and then moving at a rate greatly retarded with respect to the groundwater velocity. In general, PAHs are likely to be found sorbed to soil or aquifer solids.

They will only become airborne as a result of being adsorbed to windblown dust. Possible exceptions include naphthalene and methylnaphthalene that are slightly soluble in water and are slightly volatile. Consequently, they can be expected to move toward or within groundwater at a slightly higher rate than the other PAHs.

4.4.3 Phenolic Compounds

Phenolic compounds, including PCP, have low solubility and low volatility, but are adsorbed to soils only weakly to moderately. The degree to which they are adsorbed is strongly influenced by the character of the soil, and in particular the percentage of organic carbon. The higher the percentage of organic carbon in the soil, the slower their rate of movement. Consequently, they can leach toward water at a significant rate, and once in the groundwater, their movement will only be moderately retarded. Phenolic compounds will only become airborne in association with dust.

4.5 ASSESSMENT OF RISK

4.5.1 Toxicology of Constituents of Concern

Constituents of concern identified at the NORTAR/Former ATCO Site include BTEX, PAHs and PCP. Ethylbenzene and xylenes were the predominant BTEX compounds detected at the Site in elevated concentrations. A summary of the toxicology of each chemical of concern taken from the Agency For Toxic Substance and Disease Registry (ASTDR) toxicological profiles is provided below. The toxicological descriptions are typically based on industrial exposure (inhalation) to concentrated chemical vapors. Exposure to contaminants adhering to soil particles is less likely to result in acute reactions. Chronic and/or long-term health impacts may occur with prolonged direct contact or inhalation and ingestion of contaminated soil particles.

4.5.1.1 BTEX

Benzene: Breathing high concentrations can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Toluene: Acute poisoning resulting from exposures to high concentration of the vapors is rare with toluene. Inhalation of 200 ppm of toluene for 8 hours may cause impairment of coordination and reaction time; with higher concentrations (up to 800 ppm) these effects are increased and are observed in a shorter time. In the few cases of acute toluene poisoning reported, the effect has been that of a narcotic, the workman passing through a stage of intoxication into one of coma. Recovery following removal from exposure has been the rule.

Exposure to concentrations up to 200 ppm produces few symptoms. At 200 to 500 ppm (in air), headache, nausea, eye irritation, loss of appetite, a bad taste, lassitude, impairment of coordination and reaction time are reported, but are not usually accompanied by any laboratory or physical findings of significance. With higher concentrations, the above complaints are increased and in addition, anemia, leucopenia and enlarged liver may be found in rare cases. Toluene is not a known human carcinogen.

Ethylbenzene: In concentrated form, ethylbenzene can cause irritation to skin, eyes, and mucous membranes. Extreme exposures in animals have resulted in loss of consciousness, tremor of the extremities and death through respiratory failure. As a soil contaminant, the primary concern is leaching to groundwater and subsequent ingestion or release to surface water. The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is not classifiable as to its carcinogenicity in humans.

Xylene: Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels. As a soil contaminant, the primary concern is leaching to groundwater and subsequent ingestion or release to surface water. The IARC has determined that xylene is not classifiable as to its carcinogenicity in humans.

4.5.1.2 PAHs

Animal studies have shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. These effects have not been observed in humans. The DHHS has determined that some PAHs may reasonably be expected to be carcinogens. The following PAH compounds are categorized as carcinogenic: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene. Naphthalene is not considered to be a carcinogen.

4.5.1.3 PCP

Short-term exposures to large amounts of PCP or long-term exposure to low levels can harm the liver, kidneys, blood, lungs, nervous system, immune system, and gastrointestinal tract. Researchers have seen similar effects in animals. Impurities in commercial PCP may cause many, but not all, of its harmful effects. Direct contact with PCP can irritate the skin, eyes, and mouth, particularly when it is a hot vapor. The IARC has determined that PCP is possibly carcinogenic to humans. This conclusion is based on animal studies that showed an increased risk of cancer, specifically in the livers and adrenal glands of mice. There is no good evidence that PCP is carcinogenic to humans.

4.6 EXPOSURE PATHWAYS

Potential constituents of concern identified at the Site are present in shallow soils (up to 10 feet depth or less), with some also detected in perched formation water. Potential exposure pathways include:

- Direct contact (human) with impacted soil (primarily during excavation/construction)
- Leaching of soil contaminants to perched formation water and/or groundwater and lateral transport to Lake Union.
- Inhalation of vapors released from soil to ambient air or building interiors.

Ingestion of groundwater is not expected to be a likely route of exposure. Ecology has determined that groundwater in the vicinity of the site is not potable (Ecology, August 10, 1998 Letter to King County Department of Transportation and Chevron USA Products Company). The perched formation water and groundwater in the Site vicinity are not considered potable water sources for the following reasons:

- The perched formation water at the Site appears discontinuous and seasonal.
- The groundwater aquifer is not currently used for drinking purposes
- A municipal drinking water supply is available and is the preferred source of the King County Department of Health.
- Yield from the shallow, discontinuous perched formation water aquifer is estimated at 2 gpm and is likely to be insufficient to maintain a reliable potable supply. Ecology documented the non-potable nature of this aquifer in a letter (Ecology, 1998) to the King County Department of Transportation. This determination was based on aquifer test results from the neighboring Chevron/METRO site that showed "marginal to insufficient yield on a sustainable basis".

4.7 RISK-BASED REMEDIATION OBJECTIVES

As part of the cleanup action, the Site property is to be redeveloped for retail and residential land use. This will require the derivation and application of cleanup levels for soil and perched formation water such that the following is achieved at points of compliance where exposure to human populations is possible:

- For carcinogenic constituents of concern a residual potential cancer risk of 10^{-6} or less
- For non-carcinogenic constituents of concern a hazard index (HI) of 1.0 or less.

Soil cleanup levels as established under MCTA and chemical-specific ARARs that meet these risk levels are listed in Appendix C.

At the Site, it is anticipated that surface water cleanup levels will be employed as remedial objectives for perched formation water at the points of compliance (since the perched formation water and underlying groundwater aquifer are not considered to be potable). MTCA Method B cleanup levels for surface water (protection of Lake Union) listed in Appendix C are appropriate for Site perched formation water and groundwater and meet the risk levels specified above based on fish bioconcentration, consumption rates and other exposure factors specified in the Rule. The MTCA Method B cleanup levels are estimated to be protective of surface water, aquatic life, and sediment at Lake Union.

5.0 REGULATORY FRAMEWORK

5.1 MTCA REQUIREMENTS

In general, the MTCA requirements address hazardous waste sites in a seven-step process. The seven steps include 1) Site Discovery, 2) Initial Investigation, 3) Site Hazard Assessment, 4) Hazard Ranking, 5) Remedial Investigation/Feasibility Study, 6) Selection of a Cleanup Action, and 7) Site Cleanup. The NORTAR/Former ATCO Site has advanced to Step 5. These report presents the information required in Steps 5-Remedial Investigation/Feasibility Study, Step 6-Selection of a Cleanup Action, and presents a plan for implementing Step 7-Site Cleanup. The specific regulations addressing these requirements are described below.

- *WAC 173-340-350 State Remedial Investigation and Feasibility Study*-Environmental investigations at the Site have collected information that was necessary to develop and evaluate the feasibility of remedial actions that are appropriate for the Site and compatible with proposed Site redevelopment. This report addresses the reporting requirement described in this Section of the MTCA regulation.

- *WAC 173-340-360 Selection of Cleanup Actions*- This report presents the cleanup action selection process (feasibility study) that has been conducted and is based on the requirements outlined in this Section of the regulation. The selection process applied to this Site balanced Ecology's preference for certain cleanup technologies with the technologies that were compatible with the proposed redevelopment of the Site. The selection process also incorporated Dangerous Waste Regulation restrictions on treatment/disposal for some of the Site's potential constituents of concern. The proposed cleanup action seeks to effectively minimize the amount of remaining untreated hazardous waste at the Site and increase the overall protectiveness of human health and the environment.

- *WAC 173-340-400 Cleanup Actions*-The selected cleanup action complies with the design, construction and operational requirements of this Section of the MTCA regulation. It also meets the Dangerous Waste Regulation requirements for PCP, a listed state and federal dangerous waste. The cleanup action plan included in this report addresses these issues.

- *WAC 173-340-410 Compliance Monitoring Requirements*-A description of the compliance monitoring to be performed during and following the implementation of the remedial action is included in this report. This monitoring has been designed to confirm the long-term effectiveness of the cleanup action and that human health and the environment are protected during construction. Human health and environmental protection strategies will be incorporated into the Site health and safety plan.

- *WAC 173-340-440 Institutional Controls*-The selected cleanup action will result in residual concentrations of PCP being contained on Site using Ecology's Area of Contamination (Appendix D) and Contained In (Appendix E) policies. This is due to

federal and state land ban disposal restriction. Therefore the requirements of this Section have been incorporated into the Cleanup Action Plan (CAP).

- *WAC 173-340-520 Consent Decrees*- MTCA Amendments allow the Attorney General and Ecology to enter into settlements (Prospective Purchaser Agreements) with parties not currently liable for remedial action at facilities who propose to purchase, redevelop or reuse facilities with environmental impacts. Prospective Purchaser Agreements (PPA) are granted where they yield substantial new resources to facilitate site cleanup. For consistency with Ecology's mission to effect cleanup of contaminated sites, PPA proposals focus on how the agreement will expedite site cleanup that would not otherwise occur or would otherwise occur more slowly. The administrative mechanism for PPAs is the Consent Decree. A PPA proposal will be submitted subsequent to this CAP and under separate cover. Upon acceptance by Ecology, the PPA will be incorporated into a Consent Decree that will be negotiated with Ecology. The resultant Consent Decree will meet the requirements of this Section.

- *WAC 173-340-600 Public Participation*-Ecology's goal for providing the public with timely information and opportunity for participation is outlined in this Section. A Public Participation Plan is to be prepared and submitted under separate cover.

- *WAC 173-340-810 Safety and Health Requirements*-This Section incorporates the federal OSHA Act of 1970 (29 U.S.C. Section 651) and the State WISHA Act (Chapter 49.17 RCW) applicable to remedial actions under MTCA. A Site Health and Safety Plan that addresses the Safety and Health issues associated with the remedial action will be developed to support the clean up action.

- *WAC 173-340-820 Sampling and Analytical Plan*-The procedures to ensure that sample data of sufficient quality are generated during the remedial action and subsequent to the remedial action are presented in this report. A sampling and analysis plan to support remediation will be developed.

5.2 STATE DANGEROUS WASTE REGULATIONS

The State of Washington Dangerous Waste Regulations (Chapter 173-303 of the Washington Administrative Code [WAC]) designate certain wastes as dangerous or extremely hazardous to the public health and the environment. They provide for surveillance and monitoring of such materials until they are safely addressed. These regulations also address manifesting and record keeping requirements and disposal facility criteria. The state Dangerous Waste Regulations incorporate the Hazardous Waste Management Act of 1976 (Chapter 70.15 RCW) and the Resource Recovery and Conservation Act (RCRA) over which the State has primacy, by reference. The Dangerous Waste Regulations apply to some of the constituents of concern that are present at the Site, specifically PCP, tetrachloroethene, vinyl chloride and carcinogenic PAHs. The applicability of these Site contaminants to these regulations are described in this section

5.2.1 PCP

Site characterization identified and confirmed the presence of PCP in one area of the Site. PCP is an F-Listed Waste (F-027) "discarded or unused pentachlorophenol formulation". Some of the PCP impacted material at the Site may qualify for application of the non-codified Contained Out/In Policy. This policy is risk-based and is used to define whether an environmental medium (soils) contains listed hazardous waste constituents. Ecology makes the determination and generally applies Method A or Method B cleanup standards. Method B PCP Soil Standards (8.33 mg/kg) are likely applicable in this case. Excavated soils with PCP concentrations above 8.33 mg/kg are considered hazardous waste, are Land Banned and must be managed on Site under Ecology's Area of Contamination Policy or managed off-Site as a hazardous waste per Chapter 173-303 WAC. For soils with PCP concentrations less than 8.33 mg/kg (there are no Site soils in this category presently but may be encountered during subsequent delineation work for the Engineering Design Report), Ecology will be requested to make a "contained-out" determination that would prevent them from having to be managed as hazardous waste and make off Site disposal an acceptable option. If the impacted materials exceed the 8.33 mg/kg concentration threshold, but are close, another option for off Site disposal may be the Contingency Management Option. The Contingency Management Option also involves disposal as solid waste with some more restrictive transportation and landfill disposal requirements. These Ecology regulatory options for managing pentachlorophenol materials are described below.

5.2.1.1 Contained In Policy

The Site environmental investigation data suggest that Ecology's Contained In/Out Policy (Appendix E) may be applicable to some on Site environmental media impacted with listed hazardous waste (specifically PCP). Such material must be managed as hazardous waste until they no longer "contain" the listed hazardous waste. Environmental media may be determined to no longer contain hazardous waste when the hazardous constituents in the media fall below Site-specific, risk-based levels and the media does not exhibit a RCRA characteristic. Ecology may determine that contingent management requirements allow the Site-specific, risk-based action levels to be calculated according to MTCA standards. Ecology's policy implies that a concentration of 8.33 mg/kg PCP (MTCA Method B carcinogenic soil cleanup level) is the threshold to determine whether media "contain" an F-027-listed PCP hazardous waste. Concentrations below this value are considered to represent low risks to public health and the environment. Therefore, if statistically representative sampling demonstrate that the media in question contain less than or equal to 8.33 mg/kg PCP, the media can be "contained-out". The selected remedial action for this Site assumes that a "contained-out" determination may be applicable for a portion of the PCP-impacted soil at the Site. Once such a determination is made, Ecology typically recommends disposal of the soil in question at either a solid waste disposal facility which is regulated under Chapter 173-351 WAC (criteria for Municipal Solid Waste Landfills) within the State of Washington, or disposal in a solid waste facility that is regulated under RCRA Subtitle D outside the State of Washington. A copy of Area of Contamination policy is provided in Appendix D.

If a "contained-out" determination is sought, a written request must be made to Ecology NWRO Hazardous Waste Toxics Reduction Program. An estimate of the volume of PCP contaminated soils for which a determination is sought, representative analytical data, and a diagram showing

the location of the soil and the intended handling, transportation and final disposal plans must be included with the request.

5.2.1.2 Contingency Management Option

The relevant issues associated with the Contingency Management Option are similar to the Contained In/Out Policy. That is, if the F-027 contaminated soil contained out determination fails because the environmental media exceed the 8.33 mg/kg level, Ecology can consider applying the Contingency Management Option. This option would accept the contained out determination with more stringent restrictions if the concentration of the PCP-impacted media is very close to 8.33 mg/kg. How close is up to Ecology's discretion and the restrictions would involve extra precautions regarding transportation and disposal facility handling protocol.

5.2.1.3 Area of Contamination Policy

Some portion of the F-027 listed PCP impacted environmental media at the Site will remain listed, are land banned, and must be managed on Site under the Area of Contamination Policy (Interprogram Policy dated August 20, 1991; copy is provided in Appendix D). This policy is meant to accelerate and simplify cleanups without undermining the Dangerous Waste Regulations. This policy applies to sites in Washington being remediated under an Order or Decree. It applies only to waste management activities conducted within the Nortar/Former ATCO Site PCP-impacted area boundary.

The Area of Contamination Policy allows excavation and movement of listed media within an area of contamination without considering that a waste has been "generated" as defined by the Dangerous Waste Regulations. An Area of Contamination is defined as that portion of the Site that contains continuous contamination. Ecology must formally approve the boundary definition. Generator and land disposal restrictions will not automatically be applicable at sites where dangerous wastes are being excavated, consolidated, or otherwise moved within the defined area of contamination. Any movement of F-027 contaminated media outside the Area of Contamination will automatically invoke the dangerous waste and applicable requirements.

The application of the Area of Contamination policy will be proposed and submitted to Ecology for approval. Once approved, the Area of Contamination Policy will be applied to the Site to enable excavation, temporary storage, consolidation and construction of an isolation area for long term management of F-027 listed PCP contaminated soil. The tentative (pre-Ecology approved) Area of Contamination of F-027 listed PCP contaminated soil is defined on Figure 6 and is coincident with the area of historic PCP handling operations**.**

Concrete contaminated with PCP F-027 listed waste will be managed in a manner similar to soil contaminated with F-027 listed waste.

5.2.2 Vinyl Chloride, Tetrachloroethene and Carcinogenic PAHs

In addition to these specific policies and their applicability to PCP, the relevance of the Dangerous Waste Regulations to other Site constituents of concern (vinyl chloride, tetrachloroethene and carcinogenic PAHs) was assessed. Based on the environmental

investigations conducted at the Site, these constituents of concern do not represent dangerous waste. This is based on the fact that the solvent and carcinogenic PAH impacts are at concentrations that do not represent characteristic waste and the PAHs are substantially less than the state only waste criteria of greater than 10,000 mg/kg. Therefore, the solvent and carcinogenic PAH constituents of concern at this Site do not have associated RCRA or Dangerous Waste disposal restrictions.

5.3 APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS

The selected cleanup action for the Site will comply with applicable local, state, and federal laws and regulations. MTCA (Chapter 173-340 WAC) represents the primary regulation that establishes cleanup levels and other requirements for the Site.

Cleanup standards developed under MTCA must also meet the statutory requirement to be at least as stringent as other applicable state and federal laws. The laws and associated regulations applicable to cleanup standards developed for the Site are listed in Appendix C, Table C1, along with the rationale for inclusion.

Applicable cleanup concentrations for constituents of concern in soil are listed in Appendix C, Table C2. Since perched formation water and groundwater remediation levels at the Site will be based on meeting surface water quality criteria at the selected point of compliance, published groundwater and surface water criteria are referred to as "potentially applicable" and are listed in Appendix C, Tables C3 and C4.

5.4 OTHER ENVIRONMENTAL REGULATIONS

SEPA regulations will be addressed as part of the redevelopment construction process. In addressing the SEPA regulations as part of the redevelopment, the environmental issues associated with the Site will also be incorporated. A SEPA checklist is currently being prepared by others and will be submitted concurrent to the PPA proposal. The City of Seattle will be the lead agency for the SEPA process with input from Ecology.

5.5 CLEANUP LEVELS

Cleanup levels for the media of concern that are protective of human health and the environment, and that address the relevant exposure pathways are discussed in this section. The cleanup levels take into consideration the proposed redevelopment of the Site and proposed use as light retail and residential. The property is currently zoned for industrial use. Cleanup levels based on an industrial setting are not proposed at this time. The cleanup levels proposed in this section assume that the contract rezone from an industrial use to a mixed commercial/residential use currently under way, is successfully completed. MTCA Method B cleanup levels for the residential use of the Site are proposed in this section. If the contract rezone is not successful and Triad moves ahead with the acquisition of the property, they

reserve the right to renegotiate the proposed cleanup levels based on the current industrial zoning of the Site.

5.5.1 Soil Cleanup Levels

MTCA Method A or B soil cleanup levels will be applied to soil at the Site as follows:

- **TPH**: Soil cleanup levels for TPH are not proposed or deemed necessary for the following reasons; (1) TPH has been quantified in one sample obtained during Site characterization activities, (2) the hydrocarbons detected by TPH-HCID during Equipoise's assessment confirm the presence of primarily mineral spirits (IPD) and some heavier hydrocarbons, and (3) the hydrocarbons detected appear to be related to the presence of ethylbenzene and xylenes (compare Tables 2 and 3).

- **BTEX**: MTCA Method B soil cleanup levels are proposed for benzene, toluene, ethylbenzene, and xylenes. None of the BTEX compounds detected in soil at the Site exceeded their respective MTCA Method B soil cleanup level.

- **Vinyl Chloride**: The MTCA Method B soil cleanup level is proposed for vinyl chloride. The cleanup level was exceeded in one sample obtained from location SP4 from 1 to 4 feet below surface grade. Three samples obtained from the same boring location (SP4) at depths from 4.5 to 6, 6.5 to 7, and 7 to 8.5 feet below surface grade did not contain vinyl chloride above the analytical method detection limit.

- **Tetrachloroethene**: The MTCA Method B soil cleanup level is proposed for tetrachloroethene. The cleanup level was not exceeded in any soil samples obtained from the Site during characterization activities.

- **Carcinogenic PAHs**: The MTCA Method B soil cleanup level is proposed for the individual carcinogenic PAHs based on the assumption that the contract rezone effort is successful. The MTCA Method A soil cleanup level is proposed for carcinogenic PAHs as a group. The extent of soil with carcinogenic PAHs in excess of 1 mg/kg (the MTCA Method A cleanup level) is illustrated on Figure 5. The MTCA Method B industrial soil cleanup level (potential applicable if the current zoning does not change) for carcinogenic PAHs is 20mg/kg.

- **PCP**: The MTCA Method B carcinogenic soil cleanup level is proposed for PCP. The cleanup level was exceeded in one sample obtained from location SP4 from 1 to 4 feet below surface grade. Two soil samples obtained from the same boring location (SP4) at depths from 4.5 to 6 and 6.5 to 8.5 feet below surface grade did not contain PCP above the analytical method detection limit. The estimated extent of soil with PCP in excess of 8.33 mg/kg (the MTCA Method B carcinogenic soil cleanup level) is limited as illustrated on Figure 6. Also illustrated is the tentatively defined Area of Contamination (formal Ecology approval has not been requested or received), which is coincident with the area of historic PCP handling operations.

5.5.2 Perched formation water Cleanup Levels

MTCA Method B surface water cleanup levels are proposed for perched formation water at the Site. Surface water cleanup levels are appropriate and proposed for the following reasons:

- Perched formation water is not considered to be potable based on Ecology's non-potable determination (Ecology, 1998) at the neighboring Chevron/METRO site. Even if perched formation water is in hydraulic communication with the groundwater aquifer, the groundwater aquifer likewise is not considered potable.

- MTCA Method B cleanup levels for surface water are protective of Lake Union, a surface water body.

- Site perched formation water meets the risk levels based on fish bioconcentration, consumption rates and other exposure factors specified in the rule.

- The proposed Site redevelopment requires excavation and proposed remediation excavation associated with cleanup of carcinogenic PAHs that will effectively eliminate the perched formation water zone at the Site, thereby remediating it by eliminating it.

Based on the fact that soil remediation will also remediate perched formation water through the excavation of the perched zone, specific MTCA Method B surface water cleanup levels for each potential constituent of concern are not quoted. They are, however, the same as those provided below for groundwater.

5.5.3 Groundwater Cleanup Levels

MTCA Method B surface water cleanup levels are proposed for groundwater at the Site. Surface water cleanup levels are appropriate and proposed for the following reasons

- Groundwater beneath the Site is not considered to be potable (Ecology, 1998).

- MTCA Method B cleanup levels for surface water are protective of Lake Union, a surface water body that is the presumed discharge point for groundwater beneath the Site.

- Similar to perched formation water, Site groundwater is presumed to meet the risk levels based on fish bioconcentration, consumption rates and other exposure factors specified in the rule.

- The proposed Site redevelopment requires excavation, and proposed remediation excavation associated with cleanup of carcinogenic PAHs that will effectively eliminate the on-Site sources of constituents of concern to groundwater.

Following is a summary of the proposed cleanup levels for groundwater.

- **TPH**: A narrative cleanup level of "no visible sheen" is proposed for groundwater. This is appropriate for the Site as the potential sources of TPH to groundwater from the Site

will be eliminated by excavation; Site characterization data indicate that TPH is present in shallow soil (to approximately 8 feet deep) but not in deeper soil (from 8 to 10 feet deep), and the potential that off Site TPH sources are responsible for impacts to Wells MW-1 and MW-2 (the only Site groundwater monitoring well located along North Northlake Way off the southern boundary of the property)

- **BTEX**: The MTCA Method B surface water cleanup levels of 43 ug/l for benzene; 48,500 ug/l for toluene and 6,910 ug/l for ethylbenzene are proposed for groundwater. There is no MTCA Method B surface water cleanup level published for xylenes. Therefore the primary MCL of 10,000 ug/l is proposed for xylenes.

- **Carcinogenic PAHs**: The MTCA Method B surface water cleanup level for each of the carcinogenic PAHs of 0.0296 ug/l or the Practical Quantitation Limit, which ever is greater is proposed for groundwater. There is no MTCA Method B surface water cleanup level published for the carcinogenic PAHs as a group.

- **PCP**: The MTCA Method B carcinogenic surface water cleanup level of 4.91 ug/l is proposed for groundwater.

6.0 CLEANUP ALTERNATIVES

6.1 REMEDIATION ALTERNATIVES

Site remedial alternatives address the MTCA Screening Criteria (WAC 173-340-360), the volume and locations of impacted media, and proposed Site redevelopment plans. Various remedial alternatives were considered for the constituents of concern. Consideration was given to the effectiveness of each approach in achieving the threshold requirements (protection of human health and the environment, and compliance with the applicable cleanup standards). Alternatives that achieved the threshold criteria but had a high cost relative to the level of environmental protection achieved were not carried forward in the evaluation. Remedial options considered for each medium and constituent of concern are discussed in the following sections.

6.1.1 Soil

Soil constituents of concern requiring remedial action based on the proposed cleanup levels are carcinogenic PAHs, PCP and vinyl chloride. The following discussion describes the remedial alternatives for these constituents of concern.

6.1.1.1 PAH – Impacted Soil

PAH-impacted soil refers to soil in which carcinogenic PAHs in excess of the MTCA Method A soil cleanup level of 1 mg/kg was detected. The estimated extent of this area is presented on Figure 5. PAHs represent the greatest volume and areal extent of the constituents of concern. PAH soil impacts are found in each of the Operational Areas of the Site. The following discussion presents two PAH remediation alternatives.

PAH Remediation Alternative Number 1: This alternative includes excavation and off Site disposal of PAH-impacted soil. Since carcinogenic PAH concentrations are less than 1 percent (10,000 mg/kg), the State Dangerous Waste Regulations are not directly applicable and soil disposal in an Ecology-approved solid waste landfill is appropriate and applicable.

PAH Remediation Alternative Number 2: Excavation and off Site disposal of soil impacted with PAH at a calculated risk-based concentration between the MTCA Method A soil cleanup standard (1mg/kg) and MTCA Method A industrial soil cleanup standard (20mg/kg) is a second alternative. This alternative would remove Site soils with PAH concentrations that could leach to groundwater and be laterally transported to surface water in exceedance of surface water criteria. A contingency management strategy would be required to manage any remaining on Site soil PAH concentrations to avoid direct contact or soil ingestion risk. Long term monitoring and capping would likely be required. Although this option may be feasible it will not be retained for the following reasons; (1) it may require long-term monitoring to ensure residual PAH concentrations do not leach into groundwater, (2) there would be increased concern for the health and safety of potential future Site residents, (3) there would be increased concern for the health and safety of Site redevelopment construction personnel, (4) as currently

planned, the excavation required for Site redevelopment incorporates the entire PAH-impacted soil area, and (5) complete excavation of impacted soil (PAH Remediation Alternative Number 1) will effectively remove the perched formation water zone and eliminate the groundwater pathway eliminating them as media of concern.

6.1.1.2 PCP – Impacted Soil

PCP-impacted soil refers to soil in which PCP in excess of the MTCA Method B carcinogenic soil cleanup level of 8.33 mg/kg was detected. The estimated extent of this area is presented on Figure 6. Only one sample from one boring (using EPA Method 8270) exceeded these criteria (SP4 from 1 to 4 feet). No other EPA Method 8270 analyses were above the method detection limit.

PCP Remediation Alternative Number 1: Leave the area of PCP-impacted soil in place on Site. If the PCP-impacted soil is not excavated, then no hazardous waste is generated per the State Dangerous Waste Regulations. This option would not be applicable where redevelopment plans include soil excavation and removal. However, this approach would be viable for undisturbed PCP-impacted soil that is left undisturbed. Given the present redevelopment, this option is not feasible. Parking garage construction is currently planned in the vicinity of SP4, the only location where PCP-impacted soil (i.e., soil with greater than 8.33 mg/kg PCP) has been identified.

PCP Remediation Alternative Number 2: Excavate and consolidate PCP-impacted soil and apply the Contained-In Policy using contingency management and Area of Contamination (AOC) designation at the Site. This will require institutional controls. PCP-impacted soil would be excavated and temporarily stored in a secure above ground structure located within the AOC under the alternative. During Site redevelopment the soil would be placed in a concrete or similar structure. All PCP-impacted material handling would be conducted within the AOC. The PCP-impacted material will be placed in a secured location (e.g., a separate room, a concrete structure or vault) within the parking structure such that the public will have no access and the integrity of the containment can be monitored. At no time during Site remediation or development will the soil leave the defined AOC. This option represents the proposed PCP remediation alternative and will prevent disturbance, and eliminate the potential for leaching into groundwater.

PCP Remediation Alternative Number 3: Excavation and off Site disposal or treatment of PCP-impacted soil. Landfill disposal of the PCP-impacted soil is not a feasible option as PCP impacted soils above 8.33 mg/kg is a RCRA-listed (F-027) waste and is land banned. Off-Site treatment by thermal desorption was considered as a treatment option. However, this technology cannot be applied if the soil is a listed waste due to PCP and no acceptable waste incinerators are currently operating nationally. It is not clear whether such incinerators will be accepting PCP-impacted material in the future or if another facility will be opening. At this time this option would require costly long-term indefinite storage of the soil off site. Based on these considerations this option was not retained.

6.1.1.3 Vinyl Chloride – Impacted Soil

Vinyl chloride (VC)-impacted soil refers to soil in which VC in excess of the MTCA Method B soil cleanup level of 0.526 mg/kg was detected. The MTCA Method B soil cleanup level for VC was exceeded in one sample obtained from boring SP4 from 1 to 4 feet below surface grade. This is also the only sample in which PCP-impacted soil was detected, the extent of which is illustrated on Figure 6. Since the VC-impacted soil is present in the same location as the PCP-impacted soil the remediation option for PCP-impacted soil (Remedial Alternative #2) presented above will also address VC-impacted soil.

6.1.1.4 Other Soil Impacts

During Site characterization activities, soil with toluene, ethyl benzene, xylenes, and tetrachloroethene in excess of MTCA Method A soil cleanup levels was detected. All the detected concentrations were below MTCA Method B soil cleanup levels and the proposed remediation action levels for each constituent. The distribution of these constituents is coincident with the carcinogenic PAH-impacts. Although these constituents will not drive the proposed remediation, they will be addressed during carcinogenic PAH-impacted soil excavation.

6.1.2 Perched formation water

Site characterization activities identified shallow perched formation water at the Site. Others have described it as being "discontinuous", meaning that it occurs locally in some locations while not at others. This is similar to what has been reported at the adjacent METRO/Chevron site to the west. During Equipoise's assessment perched formation water was observed at most boring locations. This data does not necessarily conflict with that presented by others as most Site characterization performed by others was conducted during the dry season and Equipoise' investigation was conducted during the wet season. Further, Ecology determined (Ecology, 1998) that this aquifer has insufficient yield to represent a likely potential future source of drinking water at the neighboring METRO facility. These observations would appear to make remediation alternatives involving fluid extraction both ineffective and inappropriate. In addition, the proposed Site redevelopment calls for excavation to construct a below grade parking structure. This excavation would effectively eliminate the perched formation water zone on the Site and may require drains to be installed as part of the redevelopment. Based on these considerations remediation of perched formation water by methods involving extraction of fluids was not retained for further consideration.

The only location where Site characterization activities indicate the proposed perched formation water remediation levels were exceeded is MW-6. This location is within the footprint of the excavation of carcinogenic PAHs. The proposed remediation alternative for perched formation water is primarily dictated by the proposed Site redevelopment and involves excavation of the perched formation water zone.

6.1.3 Groundwater

Active groundwater remediation at the Site is not required and hence not considered for the following reasons:(1) the proposed remediation cleanup level for TPH has not been exceeded, (2) if impacted soil and the perched formation water zone are excavated, the potential on Site

source of contaminants and associated migration pathway to groundwater will be eliminated, (3) Ecology considers the groundwater aquifer to be non-potable (Ecology, 1998) and (4) the high potential for drawing contaminants toward the Site from off Site source areas if active remediation through extraction of fluid is implemented.

6.2 SELECTED REMEDIATION ACTION

The selected remediation alternative includes:

- The excavation and off Site disposal of soil impacted with carcinogenic PAHs in excess of 1 mg/kg.
- The excavation and containment of soil impacted with PCP in excess of 8.33 mg/kg in a concrete structure within a designated Area of Contamination.
- Application of Site institutional controls to ensure the integrity of the cleanup action is maintained.

The selected remediation action will also effectively eliminate the perched formation water zone and the potential for leaching of contaminants to groundwater from on Site source areas. The selected remediation alternative represents the most practicable approach to protect human health and the environment, and meets regulatory criteria and other remedial objectives.

To assure that protection of human health achieved, institutional control measures will be undertaken to limit or prohibit activities that may interfere with the integrity of the cleanup action. These measures involve physical and legal/administrative mechanisms to control future activity on the property. Physical measures limit activity on the Site that could result in exposure by employing the use of pavement, soil cover and isolating foundations. Legal/administrative mechanisms limit use and ensure maintenance of the physical measures. Site use restrictions include: restricting activities that would disturb soil covers, and restricting the use of groundwater. Maintenance activity mechanisms include inspection and maintenance of caps, containment areas (PCP containment area) and monitoring wells. Institutional controls appropriate for the Site will be described in a restrictive covenant on the property.

6.3 JUSTIFICATION FOR THE SELECTED REMEDIATION ALTERNATIVE

The selected Site cleanup action complies with applicable MTCA and related regulatory threshold requirements. These requirements include:

- Compliance with applicable state and federal laws and regulations;
- Protection of human health and the environment including surface water, aquatic life and sediment at Lake Union; and
- Compliance monitoring provisions.

The Site cleanup action will protect human health and the environment using a number of source removal, management and control measures. The primary environmental risks associated with Site impacts are direct exposure to contaminated soil during Site development and contaminant migration in the future. Cleanup efforts will excavate, consolidate and contain

these materials as needed, and as appropriate for the constituents of concern. Where needed and allowed under the provisions of the State's Dangerous Waste Regulations, other affected soil will be removed for off Site disposal at suitable landfills. The prevention of human contact with affected media, if any remain, will be provided with pavement, soil covers, other suitable containment and foundations.

The primary post-redevelopment exposure pathway of concern is to surface water via groundwater transport to Lake Union. The selected remedial alternative seeks to eliminate this potential by removing the source of contaminants and the migration pathway to groundwater, the perched formation water. Obtaining performance/compliance groundwater monitoring samples from downgradient locations subsequent to the CAP implementation will assess constituent of concern concentrations in groundwater. This will ensure that groundwater meets the surface water quality criteria and anti-degradation policy in accordance with Chapter 173-201. Remediation described above for impacted soil will effectively prevent potential future releases to these receptors. Also, Site groundwater is not currently used as a drinking water resource, and it is extremely unlikely to be used for drinking water in the future, given the non-potable determination by Ecology (Ecology, 1998) on the neighboring Chevron/METRO site and the availability of municipal water in the area.

Other cleanup alternatives that were considered involved additional off-Site treatment options for soil that would be excavated and removed from the Site. While these measures would effectively prevent exposure to contaminated materials, they provide no additional benefit with regard to risk reduction. In certain cases, such as for PCP-impacted soil, no suitable off Site disposal option currently exists. Associated costs and risks of long-term storage of PCP-impacted soil (while awaiting development of appropriate off Site disposal options) are not commensurate with the exposure reduction that would be achieved relative to on-Site management.

In addition to limiting potential exposure to human health and the environment, the preferred cleanup action will effectively achieve remedial action objectives and compliance with applicable state and federal cleanup levels. These cleanup levels will be achieved at the points of compliance upon completion of the cleanup action and planned Site redevelopment. Verification sampling and analysis will assess the effectiveness of remedial measures, and post-construction monitoring (including groundwater sampling and analysis) will continue to be conducted in accordance with an approved monitoring plan. Institutional controls will also be established in the form of a restrictive covenant to prohibit Site activities which could disturb the isolation of fill materials, or otherwise create potential exposure pathways.

Finally, the selected cleanup action will allow Triad to conduct redevelopment on a Site that meets residential soil cleanup levels. This will ensure the health and safety of construction personnel and future tenants and residents.

7.0 SELECTED CLEANUP ACTION

7.1 PROPOSED CLEANUP ACTION LEVELS

Applicable MTCA cleanup levels for the media of concern that are protective of human health and the environment, and that address the relevant exposure pathways were presented and discussed in Section 5.4. The selected remediation alternative (excavation of soil with off-Site disposal and on- Site containment within an AOC, removal of perched formation water beneath the Site, and elimination of contaminant migration pathways to groundwater and institutional controls) and proposed cleanup action levels consider the proposed Site rezoning and redevelopment. In summary, the proposed excavation remediation action cleanup levels are:

- The MTCA Method A soil cleanup level of 1 mg/kg for carcinogenic PAHs.
- The MTCA Method B carcinogenic soil cleanup level of 8.33 mg/kg for PCP.
- The MTCA Method B surface water levels (applied to perched formation water and groundwater) for TPH (no visible sheen), BTEX (benzene: 43 ug/l, toluene: 48,500 ug/l, ethylbenzene: 6,910 ug/l and xylenes: 10,000 ug/l) PAHs (0.0296 ug/l for each of the carcinogenic PAHs) and PCP (4.91 ug/l).

7.2 PROPOSED AREA OF CONTAMINATION FOR PCP

The selected remediation alternative for PCP-impacted soil includes the application of Ecology's Area of Contamination Policy. In general, the policy provides for situations in which excavation and movement of contaminated materials would not be considered generation or disposal of hazardous waste as defined by Chapter 173-303 WAC. Application of the policy is restricted to sites being remediated under MTCA through an order or decree. An AOC is defined in the policy as that portion of the Site that contains continuous contamination. Consolidation of contaminated soils within the boundaries of an AOC is allowed in order to reduce the size of the AOC and more effectively manage and monitor the residual materials. The precise proposed AOC area definition will be submitted to Ecology for approval prior to CAP implementation.

The AOC policy will be applied to PCP-impacted soil present in excess of the MTCA Method-B carcinogenic soil cleanup level of 8.33 mg/kg at the Site. As part of Site redevelopment, PCP-impacted soil within a contiguous zone of contamination will be consolidated and placed in a concrete or similar structure that will be placed within a secure area with restricted access. The tentative designated AOC for the cleanup action (formal Ecology approval has not been obtained) to be conducted under this CAP is defined by the area of historic PCP handling operations within the Wood Preservative Formulation Building. This area is illustrated on Figure 6. The concrete or similar structure that is to contain the PCP-impacted soil will be placed in a secured location such that the public will not be able to access the location and the integrity of the structure can be monitored. At no time during Site remediation or development will the soil leave the defined AOC. The final location for the secured structure will be within the AOC.

7.3 REMEDIATION OF SOIL

The selected remediation alternative includes the excavation and off Site disposal and recycling where practical of soil impacted with carcinogenic PAHs in excess of 1 mg/kg and the excavation and containment of soil impacted with PCP in excess of 8.33 mg/kg. The selected remediation action will also effectively remove the perched formation water zone and the potential for leaching of contaminants to groundwater from on Site source areas. The selected remediation alternative represents the most practicable approach to protect human health and the environment, and meets regulatory criteria and remedial objectives. In addition, the selected remediation alternative represents the best and most practical approach considering the proposed future Site use and excavation to be conducted as part of Site redevelopment.

To assure that protection of human health is achieved, institutional control measures will be undertaken to limit or prohibit activities that may interfere with the integrity of the cleanup action. These measures involve physical and legal/administrative mechanisms to control future activity on the property.

7.4 PROPOSED POINTS OF COMPLIANCE

In accordance with MTCA, the points of compliance proposed for soil at the Site include the excavation margins (vertically and horizontally) from ground surface to a depth of 15 feet or the total depth of the excavation, whichever is greater. This area represents the zone where ingestion and contact are the most likely exposure pathways of concern. Upon completion of the remediation action, soil at the Site will meet the proposed cleanup action levels.

The proposed points of compliance for groundwater are Wells MW-1 and MW-2, located along the south property boundary and three monitoring wells along the west property boundary. Monitoring wells such as METRO MW-13, -17, -23) that may be down gradient of the property line could serve to monitor the points of compliance along the west property boundary. In the event that Site redevelopment requires closure of these wells, replacement wells will be installed at or near existing monitoring wells.

This groundwater point of compliance location was developed to ensure protection of Lake Union water quality and aquatic life. Ecology does not consider groundwater at the Site potable (Ecology, 1998). Therefore, eliminating the potential for migration of contaminants within groundwater in sufficient concentrations to exceed surface water criteria at the discharge point to Lake Union needs to be confirmed at the points of compliance. Given the data from environmental investigations conducted at the Site and in association with surrounding properties, no surface water criteria exceedances are anticipated at the proposed points of compliance. For this reason, no arguments for cleanup action levels that exceed surface water criteria at the proposed points of compliance have been made at this time. Triad reserves the right to make such arguments, taking into account natural attenuation of Site contaminants between the site and Lake Union, in the future.

8.0 COMPLIANCE MONITORING

Compliance monitoring will be conducted in accordance with Chapter 173-340-410 and include provision for protection monitoring, performance monitoring and confirmation monitoring. The following discussion describes the proposed monitoring strategy.

8.1 PROTECTION MONITORING

Protection monitoring will be conducted during implementation of the remediation action to confirm that human health and the environment are adequately protected. Protection monitoring requirements are to be documented in the Site Health and Safety Plan (HASP) that will be submitted in conjunction with the Engineering Design Documents. The HASP will be reviewed and revised as required to include the remediation action tasks discussed in the Engineering Design Documents. These documents will be submitted to Ecology prior to the CAP implementation.

8.2 PERFORMANCE MONITORING

Performance monitoring of Site soil and perched formation water will be conducted during and subsequent to the CAP implementation. On Site soil performance monitoring to verify achievement of excavation goals in the PCP AOC and the area-wide excavation will be accomplished. Performance soil monitoring will also be conducted prior to soil excavation to further delineate the PCP soil impacts within the AOC to ensure that the Dangerous Waste regulations are appropriately applied. Detailed performance soil monitoring requirements will be presented in the Engineering Design documents prior to CAP implementation in a Sampling and Analysis Plan (SAP) prepared in accordance with Chapter 173-340-820. The SAP will describe the number of samples, method of sampling and analytical strategy, and QA/QC requirements to ensure cleanup levels are met. The SAP will follow Ecology guidance provided in the Ecology document: *Guidance on Sampling and Data Analysis Methods,* January 1995. The SAP will describe a systematic surface soil sampling and statistical data evaluation approach that will be conducted in the bottom/base and sidewalls of both the AOC and the area-wide excavation. A minimum of 10 performance monitoring soil samples will be obtained from the AOC and a minimum of 10 samples will be analyzed within the area-wide excavation. A statistical analysis following the Ecology guidance provided in the document: *Statistical Guidance of Ecology Site Managers,* August 1992 will be performed on the data to ensure these two areas comply with the remediation cleanup levels. The SAP will be included with the Engineering Design Documents that will be submitted to Ecology prior to the CAP implementation.

Performance monitoring of perched water will be conducted. A goal of the CAP implementation is to remove the perched water formation in the vicinity of contamination. The elimination of perched water will prevent a contaminant migration pathway to groundwater. Prevention of contaminant migration to groundwater in turn protects against contaminant migration to Lake

Union. Performance monitoring to verify the elimination of perched water in the vicinity of the Site contamination will be conducted. This will be accomplished through visual inspection and documentation of conditions within the soil excavation areas. The details of the perched water performance monitoring will be described in the SAP.

8.2.1 Delineation of Soil Excavation Area and AOC

The Engineering Design Document will include a formal AOC definition proposal to Ecology.. Prior to implementation of soil excavation in the finalized AOC and the area-wide location, the location and elevation of each boring in the vicinity of these two areas and the corners of the AOC will be surveyed and marked. These locations will facilitate the CAP implementation. Locations will be based on the Engineering Design data and once staked, the AOC protocols will be followed for the duration of the CAP implementation.

8.2.2 Soil Sampling

During the excavation phase of CAP implementation, soil samples will be collected and analyzed in sufficient number to confirm that the delineation of the soil excavation area and the AOC were properly defined and that in-situ soil remaining upon completion of excavation meets the cleanup action levels. It is anticipated that a mobile laboratory will be available on Site to support the analytical needs of the project. Confirmation analyses from a fixed-based will also be conducted. Because of the biased nature of screening PCP analyses conducted at the Site previously, EPA Method 8270 will be used to define the boundaries of PCP-impacted soil in the AOC. The details of this proposed sampling will be provided in the SAP in the Engineering Design documents.

8.2.3 Groundwater Sampling

Upon completion of excavation of the soils and perched water formation, samples will be obtained from groundwater point of compliance wells and analyzed for groundwater constituents of concern. These data will be compared with proposed MTCA method B surface water levels that are based on the protection of contaminant migration to Lake Union. The results of this comparison will be used to evaluate whether Lake Union water quality and aquatic life appear to be threatened. If surface water criteria at the points of compliance are exceeded, it may be necessary to introduce a contaminant natural attenuation analysis, and contingency measures will be added. Such an analysis would attempt to approximate the concentration of contaminants at their projected discharge point to Lake Union. If surface water criteria are not exceeded it may be appropriate to propose no further groundwater cleanup actions. In addition, all on Site contaminant sources will have been removed greatly diminishing future chances of new constituent of concern detections.

8.3 CONFIRMATION MONITORING

Confirmation monitoring will be conducted, as necessary, to confirm the long-term effectiveness of the remediation action. A confirmation monitoring strategy will be proposed in the SAP that

will be included with the Engineering Design Documents that will be submitted to Ecology prior to the CAP implementation.

8.3.1 Soil Sampling

It is anticipated that confirmation monitoring for soil will not be necessary and that performance monitoring will have confirmed soil cleanup action levels. Upon completion of CAP implementation, soil with constituents of concern in excess of their respective cleanup action levels will have been excavated. This will be confirmed by the statistically representative performance monitoring sampling and analyses that will be conducted during the CAP implementation. The implementation of the CAP will not be complete until performance monitoring determines all soil above cleanup levels has been appropriately addressed. If not, further excavation will be conducted, resampled for performance monitoring until cleanup action levels are achieved or a maximum reasonable depth, a depth of 15 feet below ground surface or depth of excavation which ever is deeper. If contamination is left on Site, then a marker bed will be placed prior to the clean fill or new building structure. If contamination is left on Site, a restrictive covenant will be required and any future construction requiring penetration or disturbance to the subsurface will require an Ecology approved plan.

8.3.2 Groundwater Sampling

If the results of performance monitoring indicate that no constituents exceed their cleanup action level, confirmation monitoring will be limited. At a minimum, confirmation monitoring will require at least two sampling events (wet and dry season) in addition to the historic data results to establish method B surface water levels have been achieved. If the results of performance monitoring indicate that one or more of the constituents exceed their cleanup action level and a natural attenuation analysis indicates that Lake Union water quality and aquatic life may be threatened by the encountered concentrations at the point of compliance, then the two sampling events will be used to identify further compliance monitoring. . The frequency and duration of the proposed confirmation monitoring will be presented in the SAP included in the Engineering Design documents that will be submitted to Ecology for approval prior to the CAP implementation. If confirmation monitoring identifies detections or cleanup action level exceedances, these data will be evaluated using Ecology's Statistical Guidance for Ecology Site Manager document.

8.3.3 Periodic Review

Periodic review will be conducted at a minimum of five years to assure that human health and the environment continue to be protected as required in WAC 173-340-420(1).

8.4 INSTITUTIONAL CONTROLS

Institutional controls will be undertaken to limit activities that could potentially interfere with the integrity of the PCP containment structure that is to be isolated within the AOC and to restrict the use of ground water. Controls will include both physical and legal/administrative mechanisms to control future activity on the property. Physical measures will include signs,

fencing or a dedicated room to keep the general public from the containment structure. Legal and/or administrative mechanisms will include the identification of the AOC and may include deed restrictions on activities to ensure the containment structure integrity is maintained and to restrict the future use of ground water.

8.5 CLOSURE PROTOCOL

Upon successful implementation of the CAP as determined by compliance monitoring, a Certificate of Completion letter will be issued by Ecology. A Certificate of Completion will be requested from Ecology once compliance monitoring verifies:

- Carcinogenic PAHs in Site soils above 1 ug/kg have been removed from the Site;
- PCP concentrations above 8.33 ug/kg in Site soils have been effectively contained on Site and in the AOC;
- Perched water formations in the vicinity of on site contamination have been removed through excavation;
- Point of Compliance groundwater monitoring well sampling and analysis data meet the method B surface water levels for the Site constituents of concern or an Ecology approved analysis of contaminant natural attenuation protecting points of discharge to Lake Union for both water quality and aquatic life; and
- Documentation that institutional controls have been implemented at the site.

Following the issuance of the Certificate of Completion, Ecology will request the removal of the facility from the Hazard Ranking List and publish notice in the State Register pursuant to WAC 173-340-330 (4).

9.0 SCHEDULE FOR IMPLEMENTATION

The CAP implementation schedule is contingent on the property redevelopment schedule. Therefore, unforeseen impacts to the redevelopment schedule may impact the remediation schedule. Impacts to the redevelopment schedule may include delays in the site rezoning process, unsuccessful rezoning results, or lack of sufficient public support of the project. If no unforeseen impacts to the redevelopment schedule occur, redevelopment may begin as early as Fall/Winter 1999. The implementation of the CAP must be completed before redevelopment construction begins. Many key milestones occur between now and the redevelopment construction startup. These milestones, along with tentative startup dates assuming redevelopment begins in fall 1999, include those listed below:

1. Prospective Purchaser Agreement Proposal Submittal – **December 1998**
2. SEPA Checklist Submittal – **December 1998**
3. Public Participation Plan Submittal- **December 1998**
4. Final Cleanup Action Plan- **January 1999**
5. Public Comment Period (30 days following recording PPA Consent Decree)- **January/February 1999**
6. Public Meeting (during the Public Comment Period)— **January/February 1999**
7. Responsiveness Summary—**March 1999**
8. Complete and Lodge the PPA Consent Decree **–early 1999**
9. Engineering 90% Design (for CAP implementation) Document Submittal (to be completed 30 days after completion of responsiveness summary—**spring 1999**
10. Ecology Engineering Design (90%) Document Review (30 days)—**spring 1999**
11. Engineering 100% Design Document Submittal (15 days after Ecology Review)—**summer 1999**
12. CAP Implementation (start 45 days from Final Engineering Design Document submittal) – **Start in August 1999 and complete October 1999 (duration: 60 days)**
13. Draft Compliance Monitoring Report (complete 60 days from CAP Implementation completion, estimated to be December 1999)—**December 1999**
14. Ecology Compliance Monitoring Report Review (30 days from draft submittal)—**February 2000**
15. Final Compliance Monitoring Report Submittal (30 days from receipt of Ecology comments)—**April 2000**
16. No Further Action Letter/Restrictive Covenant From Ecology (30 days from submittal of Final Compliance Monitoring Report)—**May 2000**

10.0 REFERENCES

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Ms. Judy Riley, King County Department of Transportation and Ms. Ann Marie Johnson, Project Manager, Chevron USA Products Company Regarding Method B Surface Water Cleanup Level Standards Applicable to the Chevron/Metro Site.

Equipoise Corporation, February 13, 1998, Supplemental Investigation Workplan Former ATCO Property

Equipoise Corporation, March 10, 1998, Health and Safety/Emergency Response Program Document Former ATCO Property

Hart Crowser, May 25, 1990, Draft Report American Tar Company Groundwater Assessment

Pacific Environmental Group, Inc. August 29, 1997. Environmental Assessment of the Former Chevron Bulk Terminal 100-1327, Metro Facilities North, Seattle, WA (and subsequent

groundwater monitoring reports from sampling and analyses conducted at on site and off site monitoring wells).

SEACOR, September 15, 1990, Supplemental Hydrogeologic Site Characterization Report

Seattle-King County Department of Public Health, June 9, 1997, Site hazard Assessment – American Tar Company Ecology I.D. No. N-17-0049-000

SECOR, August 21, 1996, Groundwater Monitoring Well Sampling Former ATCO Facility
Shannon & Wilson, Incorporated, September 15, 1986, Soil Quality Evaluation ATCO Plant

Washington State Department of Ecology, January1996, The Model Toxics Control Act Cleanup Regulation, Chapter 173-340 Washington Administrative Code

Washington State Department of Ecology, January1994, Dangerous Waste Regulations, Chapter 173-303 Washington Administrative Code

Table C1 - Applicable Laws and Regulations

Law or Regulation	Rationale
Soil	
Federal	
Resource Conservation & Recovery Act (RCRA) 40 CFR 260-270	Transport, storage and disposal of solid wastes
State	
The Model Toxics Control Act Cleanup Regulation - (MTCA – Chapter 70.105D RCW and Chapter 173-340 WAC)	Soil contaminant concentrations exceeding Method A or B residential cleanup levels. Method B carcinogenic soil cleanup level for PCP of 8.33 mg/kg Cleanup levels for air adjacent to contaminated soils (WAC 173-340-750)
State Hazardous Waste Management Act (RCW 70.105) and State Dangerous Waste Regulations (Chapter 173-303 WAC)	Methods for designating waste as dangerous waste and off Site transport, storage and disposal procedures for soil categorized as dangerous waste.
State Environmental Protection Policy Act (WAC 97-11-800)	Grading in Excess of 500 Cubic Yards
Area of Contamination (AOC) Policy	Contingent management for PCP-impacted soil remaining on Site above the MTCA Method B carcinogenic soil cleanup level
Contained-In Policy	Excavation and disposal of PCP-impacted soil as solid waste if soil meets MTCA Method B carcinogenic soil cleanup level.
Ecology TPH Interim Policy	Alternate cleanup level determination for TPH-impacted soil that may be employed during construction. Requires VPH/EPH analytical (TPH fraction) methodologies.
Local	
City of Seattle Stormwater, Grading and Drainage Control Code (Chapter 22.800)	Stormwater protection, grading and drainage control requirements for projects with greater than 9,000 feet of developmental coverage.
Puget Sound Air Pollution Control Authority	Remedial activities associated with dust and chemical emissions.

Table C1 - Applicable Laws and Regulations (continued)

Law or Regulation	Rationale
Groundwater	
Federal	
Clean Water Act (33 USC 1251) and Ambient Water Quality Criteria (Section 304 and 40 CFR part 131)	Groundwater constituent concentrations for which no MTCA Method B surface water cleanup levels exist, and which exceed drinking water MCLs.
State	
MTCA (Chapter 70.105D RCW and Chapter 173-340 WAC)	Groundwater contaminant concentrations for which no surface water cleanup levels exist, and which exceed Method B groundwater cleanup criteria.
Water Pollution Control Act (RCW 90.48) and Surface Water Quality Standards (Chapter 173-201A)	Groundwater contaminant concentrations which exceed Surface Water Quality Standards.
Surface Water	
Federal	
Clean Water Act (33 U.S.C. 1344) Section 404 (U.S. Army Corps of Engineers)	The Corp makes the final determination as to whether an area meets the wetland definition and would be subject to regulation under the Corps program.
State	
MTCA (Chapter 70.105D RCW and Chapter 173-340-730 WAC)	Surface water cleanup standards
Water Quality Standards for Surface Water of Washington (Chapter 173-201 WAC)	Addresses water quality criteria and anti-degradation policies for surface waters of Washington State
Shoreline Management Act (RCW 90.58)	Construction valued at greater than $2,500 within 200 feet of the shoreline.

Table C2 – Applicable Regulatory Cleanup Criteria for Contaminants of Concern in Soil

Constituent / CAS Number	Cleanup Level	Regulation (1)
PCP (mg/kg)	8.33	MTCA Method B carcinogenic soil(WAC 173-340-740)
VOCs (mg/kg)		MTCA Method A soil (WAC 173-340-740)
Benzene 71-43-2	0.5	
Toluene 108-88-3	40	
Ethylbenzene 100-41-4	20	
Xylenes 1330-20-7	20	
Vinyl chloride 75-01-4	0.526	MTCA Method B soil (WAC 173-340-740)
SVOCs (mg/kg)		MTCA Method A soil (WAC 173-340-740)
PAHs (carcinogenic) (total)	1.0	
		MTCA Method B soil (WAC 173-340-740)
Individual CPAH (mg/kg):		
Benzo(a)anthracene 56-55-3	0.137	
Benzo(b)fluoranthene 205-99-2	0.137	
Benzo(k)fluoranthene 207-08-9	0.137	
Benzo(a)pyrene 50-32-8	0.137	
Chrysene 208-01-9	0.137	
Dibenz(a,h)anthracene 53-70-3	0.137	
Indeno(1,2,3-cd)pyrene 193-39-5	0.137	
Naphthalene (mg/kg) 91-20-3	3,200	
TPH	To be determined as needed during construction (2)	Ecology Interim TPH Policy Derived

PCP: Pentachlorophenol
VOCs: Volatile Organic Compounds
SVOCs: Semivolatile Organic Compounds
TPH: Total Petroleum Hydrocarbons

(1) MTCA Method B values from Ecology CLARC II Database (February 1996).

(2) Most TPH attributed to BTEX and PAH. Cleanup requirements for area where TPH is only contaminant of concern will be determined during construction field screening using Interim TPH Policy analytical methodology to set the Site-specific cleanup level.

Table C3 – Potentially Applicable Regulatory Cleanup Criteria for Contaminants of Concern in Groundwater

Constituent / CAS Number	Cleanup Level	Regulation (1)
PCP (ug/l)	0.729	MTCA Method B (WAC 173-340-740)
VOCs (ug/l)		MTCA Method A (WAC 173-340-740)
Benzene 71-43-2	5	
Toluene 108-88-3	40	
Ethylbenzene 100-41-4	30	
Xylenes 1330-20-7	20	
Vinyl chloride 75-01-4	0.2	
SVOCs (ug/l)		MTCA Method A (WAC 173-340-740)
PAHs (carcinogenic) (total)	0.1	
		MTCA Method B (WAC 173-340-740)
Individual CPAH (ug/l):		
Benzo(a)anthracene 56-55-3	0.012	
Benzo(b)fluoranthene 205-99-2	0.012	
Benzo(k)fluoranthene 207-08-9	0.012	
Benzo(a)pyrene 50-32-8	0.012	
Chrysene 208-01-9	0.012	
Dibenz(a,h)anthracene 53-70-3	0.012	
Indeno(1,2,3-cd)pyrene 193-39-5	0.012	
Naphthalene (ug/l) 91-20-3	320	
TPH (ug/l)	1,000	MTCA Method A (WAC 173-340-740)

PCP: Pentachlorophenol
VOCs: Volatile Organic Compounds
SVOCs: Semivolatile Organic Compounds
TPH: Total Petroleum Hydrocarbons
(1) MTCA Method B values from Ecology CLARC II Database (February 1996)

Table C4 – Potentially Applicable Regulatory Cleanup Criteria for Contaminants of Concern in Surface Water.

Constituent / CAS Number	Cleanup Level	Regulation (1)
PCP (ug/l)	4.91	MTCA Method B (WAC 173-340-730)
VOCs (ug/l) (2)		MTCA Method B (WAC 173-340-730)
Benzene 71-43-2	43	
Toluene 108-88-3	48,500	
Ethylbenzene 100-41-4	6,910	
Xylenes 1330-20-7	10,000	(primary MCL)
Vinyl chloride 75-01-4	2.92	
SVOCs (ug/l)		
PAHs (carcinogenic) (total)	(not listed)	
		MTCA Method B (WAC 173-340-730)
Individual CPAH (ug/l):		
Benzo(a)anthracene 56-55-3	0.0296	
Benzo(b)fluoranthene 205-99-2	0.0296	
Benzo(k)fluoranthene 207-08-9	0.0296	
Benzo(a)pyrene 50-32-8	0.0296	
Chrysene 208-01-9	0.0296	
Dibenz(a,h)anthracene 53-70-3	0.0296	
Indeno(1,2,3-cd)pyrene 193-39-5	0.0296	
Naphthalene (ug/l) 91-20-3	9,880	

PCP: Pentachlorophenol
VOCs: Volatile Organic Compounds
SVOCs: Semivolatile Organic Compounds
(1) MTCA Method B values from Ecology CLARC II Database (February 1996)
(2) Xylene: Primary MCL – no MTCA Method B listing for surface water . Primary MCLs for other VOCs are as follows: benzene: 5.0 ug/L; toluene: 1,000 mg/L ethylbenzene: 700 ug/L; vinyl chloride: 2.0 ug/L.